PB81-219800

Farmland Industries, Inc., Phosphate Mine Hardee County, Florida. Supplemental Information Document. Volume 2

(U.S.) Environmental Protection Agency
Atlanta, GA

May 81

U.S. Department of Commerce
National Technical Information Service
NTIS

BIBLIOGRAPHIC DATA SHEET

1. Report No. EPA904/9-81-072B

2.

3. Recipient's Accession No. PB81 219800

4. Title and Subtitle
Farmland Industries, Inc. Phosphate Mine, Hardee County, FL
Draft Envionmental Impact Statement
Volume II

5. Report Date May 1981

6.

7. Author(s) EIS Preparation Section, EIS Branch, Region IV

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Environmental Protection Agency, Region IV
345 Courtland Street
Atlanta, GA 30365

10. Project/Task/Work Unit No.

11. Contract/Grant No. Draft

12. Sponsoring Organization Name and Address
Same.

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstracts

Farmland Industries, Inc. has proposed an open pit phosphate mine and beneficiation plant on a 7810-acre site in west central Hardee County, Florida. Mining and processing will involve 5280 acres, all of which will be reclaimed, and will produce 2 million tons of phosphate rock per year for 20 years. The EIS examines alternatives, impacts and mitigative measures related to air, geology, radiation, groundwater, surface water, ecology and other natural and cultural systems.

17. Key Words and Document Analysis. 17a. Descri .s

Farmland Industries, Inc.
phosphate
Hardee County
Florida
Mining
processing

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page) UNCLASSIFIED

21. No. of Pages

22. Price

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

May 29, 1981

REF: 4SA-EIS

TO: ALL INTERESTED GOVERNMENTAL AGENCIES, PUBLIC GROUPS, AND CONCERNED INDIVIDUALS.

The Draft Environmental Impact Statement for the Farmland Industries Phosphate Mine and Beneficiation Plant is enclosed for your review. This document has been prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) (Public Law 91-190) and applicable EPA regulations at 40 CFR Part 6.9. A Supplemental Information Document (in two volumes) has also been prepared which contains the supporting data related to the EIS. While the Draft EIS is a complete document, much of the technical detail has been presented in the Supplemental Information Document (SID) to reduce the length of the DEIS, to make the DEIS more analytical than encyclopedic, and to make the DEIS more understandable to the non-technical public. The Draft EIS and the SID may be reviewed at the following locations:

Lakeland Public Library, Lakeland, Florida
Bartow Public Library, Bartow, Florida
Ausley Memorial Library, Wauchula, Florida
DeSoto County Public Library, Arcadia, Florida
Selby Public Library, Sarasota, Florida
Manatee County Library System, Bradenton, Florida
Tampa-Hillsborough County Public Library, Tampa, Florida
Punta Gorda Public Library, Punta Gorda, Florida

A public hearing to discuss this project has been scheduled for July 14, 1981, at 7:00 p.m. in the Hardee County Agricultural and Civic Center, located at Altman Road and Stenstrom Road in Wauchula, Florida. Persons may begin to register at 6:30 p.m.

Persons wishing to make comments should attend and speak at the hearing. A verbatim transcript will be made of this public hearing. The hearing chairman may request that lengthy or technically complex statements be summarized and that, to ensure accuracy of the record, such statements be submitted in writing to:

Ms. A. Jean Tolman
EIS Project Officer
Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

The hearing record will remain open and additional written comments may be submitted through July 28, 1981. Such additional comments will be considered as if they had been presented at the public hearing.

Recipients of this document should be aware that EPA will not reprint the material contained in the DEIS for the Final EIS. The Final EIS will consist of the Agency's statement of findings, any pertinent additional information or evaluations developed since publication of the Draft EIS, comments on the project and the Agency responses and the transcript of the public hearing.

Please bring this notice to the attention of all persons who may be interested in this matter.

Sincerely yours,

Rebecca W. Hanmer

Rebecca W. Hanmer
Regional Administrator

Enclosure: DEIS

United States
Environmental Protection
Agency

Region 4
345 Courtland Street NE
Atlanta, Ga. 30365

EPA 904/9-81-072B
May 1981

PB81-219800

Environmental Impact Statement

Draft

Farmland Industries, Inc. Phosphate Mine Hardee County, Florida

Supplemental Information Document

Volume 2

PRODUCT OF:
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

SUPPLEMENTAL INFORMATION DOCUMENT
VOLUME 2

Farmland Industries, Inc.
Phosphate Mine
Hardee County, Florida

May, 1981

Prepared for: U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Prepared by: Woodward-Clyde Consultants
Environmental Systems Division
1373 Broad Street
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8.0
AQUATIC ECOLOGY

8.1 THE AFFECTED ENVIRONMENT

8.1.1 REGIONAL DESCRIPTION

The aquatic systems at the proposed Farmland mine site consist of a river at the eastern property boundary and three streams which eventually empty into the river south of the Farmland property. All systems originate north of the property and flow in a general southerly direction. From east to west, the systems are: Peace River, Troublesome Creek, Hickory Creek, and Oak Creek.

The waters in these streams are a dark brown color, the result of organic acids leached from decaying organics in adjacent marshes and hardwood swamps. The streams are typical of other natural streams in Hardee County--dark water, "tannin", swamp, and bog streams frequently with low dissolved oxygen levels.

Flow gradients are generally shallow causing the stream flow to be sluggish except during storm events. Following storms the streams often overflow their shallow banks and flood adjacent swamps and marshes. All streams on the property except Troublesome Creek are intermittent--flowing during the wet season (July-Sept) and pooled or dry in the upper reaches during much of the rest of the year.

Extreme fluctuations in stream depth and velocity resulting from the alternating wet and dry hydroperiod are the most obvious physical aspects of the streams. The range of flows--from rushing streams out of their banks to dry or barely wet stream beds--produces a stressed environment in terms of water quality, bottom type, detrital impact and movement of stream organisms.

Water quality depends to a great extent on the rate of stream flow. Following storm events, streams experience increased run-off from the adjacent marshes, rangeland, and citrus groves. This causes increased levels of silt (turbidity) which can reduce photosynthesis and clog the gills of benthic organisms. During the dry season stagnation of water in small pools results in lowered dissolved oxygen values. Other stretches of the stream bed, however, may be completely dry.

Bottom habitat, which strongly influences number and diversity of organisms, is determined to a large extent by the local stream flow velocities. A sand/silt substrate can be found in sections that flow constantly and in those that are totally dry during part of the year. Terrestrial grasses are found in some ditches and small stream branches that are dry most of the year. A third bottom type--a thick detrital or peat layer--is found in the small pools and macrophyte-choked canals that contain water most of the year.

Elevated stream flows during the wet season wash detritus out of the marshes into the streams. Storm events tend to move the detritus further downstream into the Peace River. According to Snedaker and Lugo (1972), as much as 90 percent of the energy flow is through the detritus-based food web in streams such as those on the Farmland property. Detritus also provides good habitat for a diversity of benthic organisms.

The intermittent nature of the streams limits movement of the fish and mobile invertebrates to those periods when water is flowing. During periods of high flow, fish move out of the small pools and downstream population "reservoirs" upstream into even the most remote ditches and canals. As the streams dry up, they move back into the remaining pools and downstream sections. The stream biota are primarily composed of species which can colonize upstream areas quickly or can withstand the stresses imposed by the intermittent stream flow.

Stream biota on the Farmland site were sampled by Environmental Science & Engineering, Inc. (ESE) in 1977-1978. The biota sampled included phytoplankton, macrophytes, benthic invertebrates, and fish. Phytoplankton are algae in the water column which contribute to the primary productivity in a stream community, while those algae species attached to a substrate are called periphyton. The two species assemblages are not mutually exclusive. Macrophytes are higher plants, either rooted such as cattails (Typha sp.) or floating such as water hyacinth (Eichornia sp.), which can alter stream flow and provide increased habitat for the invertebrates and fish. Benthic invertebrates are those animals living in the bottom sediments or on a substrate in the stream. They reflect the environmental conditions of the stream because of their limited mobility. Fish are the most obvious members of the stream community. They feed on plankton and a large segment of the benthic population.

Macrophytes were sampled in marshes and swamps adjacent to Hickory and Oak Creeks. Phytoplankton, invertebrates, and fish were sampled at representative stations in the Peace River, streams, marshes, and canals. See Figure 8-1 for station locations and Table 8-1 for station habitat classifications. Each stream system was sampled at a limited number of stations located where the streams enter and leave the Farmland property and in areas of particular interest such as Oak Creek Islands. The fauna and flora collected are reflective of the habitat (i.e., substrate, macrophyte growth) at the sampling stations and therefore are unique to each station. However, since the water within a

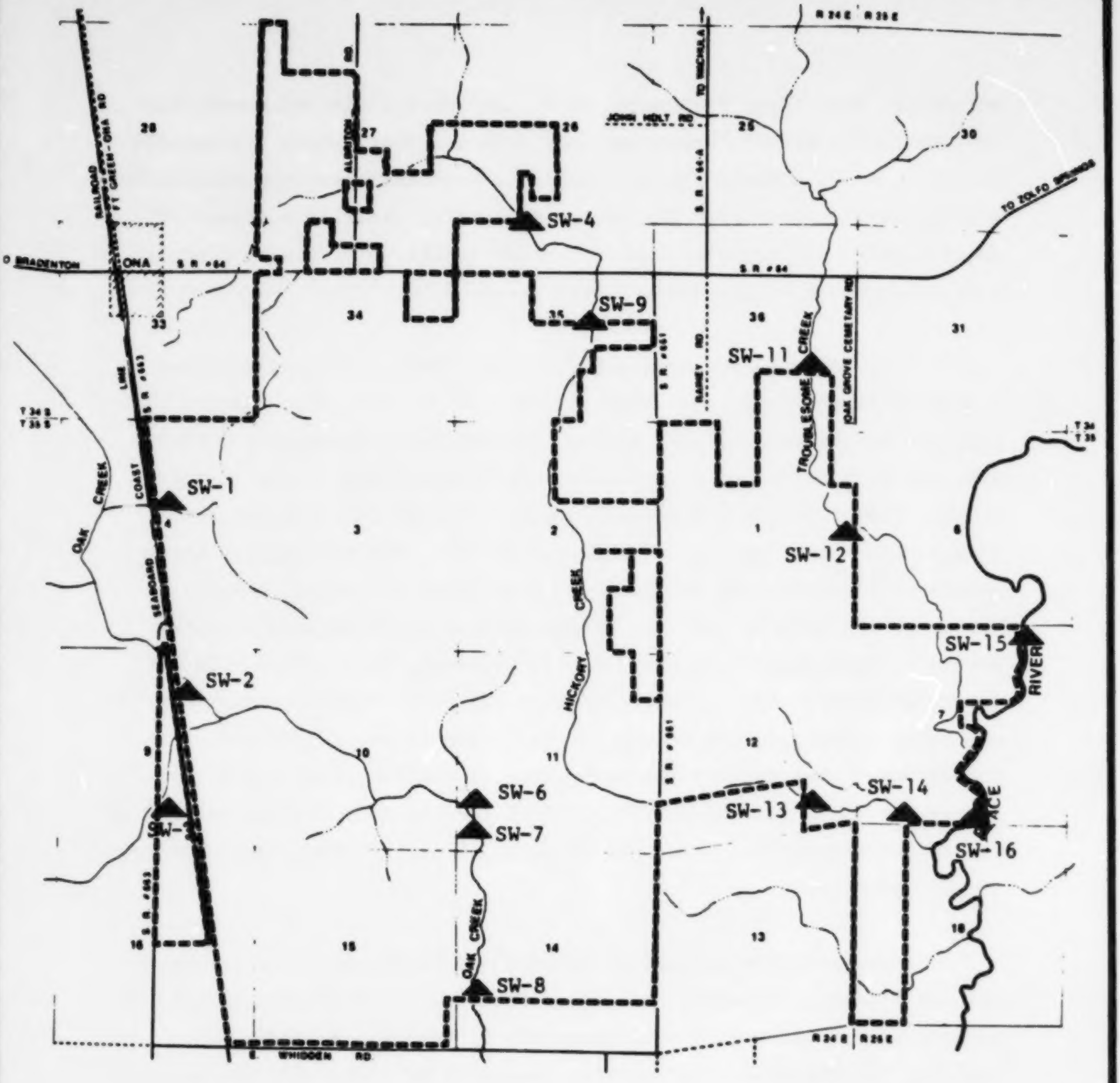


FIGURE 8-1. AQUATIC SAMPLING STATIONS.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

system is derived from a contiguous drainage basin, and that water provides a physical connection between stations within a particular stream system, results of the aquatic sampling are presented and discussed by stream system where sufficient data exist to enable distinction among systems. A description of each system precedes the aquatic data presentation. A complete listing of the physical parameters including water temperature, dissolved oxygen, percent oxygen saturation, pH and turbidity for each station is presented in Tables 8-2 through 8-6.

Stream System Descriptions

The Peace River forms the eastern border of the Farmland property. It is a major river basin in southwest Florida, originating in the Great Swamp, Polk County; the Peace River begins at the junction of Saddle Creek and Peace Creek. The river and its tributaries drain 2907 square miles in Polk, Hardee, DeSoto, Charlotte, and Manatee Counties, finally emptying into Charlotte Harbor. Current velocities and flow volumes vary through the year in response to fluctuating inputs from its many tributaries. Maximum and minimum flows measured at Arcadia from 1931 to 1973 were 36,200 and 37 cubic feet per second, respectively (Texas Instruments 1978).

During ESE's biological sampling in 1977-78 at stations SW-15 and 16, flows went from highs described as rapid and strong during most months to lows of less than one foot per second in March-May 1978. The substrate at these aquatic biology sampling stations was primarily sand with some mud; a large area of macrophytes bordered SW-16. Water quality was generally acceptable for fish and macroinvertebrates. Water temperature ranged between 10.5 and 29°C, and dissolved oxygen values varied immensely with temperature, from a low of 5.4 mg/l (July 1977) to a high of 9.7 mg/l (February 1978). Water of the Peace River was slightly acidic with a mean pH of 6.5 (ESE unpublished aquatic data).

Troublesome Creek originates north of the Farmland property and flows through the extreme northeast corner of the proposed mine site. Flow within Troublesome Creek is slow--between 0.0 and 1.5 feet per second--but it is the only stream on the property that is not intermittent (Farmland 1979). Means for water temperature, D.O. and pH are 21.5°C, 7.5 mg/l and 6.6, respectively, while the ranges are not as extreme as those in the intermittent streams. Station SW-11 had a sandy bottom with some detritus; it was 8-20 feet wide and 6 inches to 5 feet deep, depending on stream flow. Stream flow was always measurable at SW-11 but often was not measurable at SW-12 possibly because of its greater width. Mud, leaves, and some sand at SW-12 reflect the lower stream velocity.

Hickory Creek originates north of the Farmland property. On the proposed mine site it drains an area that is primarily improved rangeland and citrus groves. It flows into the Peace River just below Station SW-14. Stations SW-4, which is in a marsh, and SW-9 were dry during June 1977 and April-May 1978. SW-14 was dry in June 1977.

Dissolved oxygen at all four stations on Hickory Creek fluctuated over a wide range. Hypoxic values less than 1.0 mg/l were measured at the two upstream stations in October. Highest D.O. levels of 11-12.2 mg/L were recorded in January-February 1978 at all stations. Water temperature and pH were similar at all stations. Temperature range was 6.5-31°C; pH range and mean were 5.1-7.7 and 6.3, respectively.

Stream flow was 0.0-2.0 feet per second at the four stations. Stations SW-4 and -9 had substrates of sand and some detritus. SW-13 had a bottom of sand and scattered gravel. SW-14 had a bottom of sand plus some mud and detritus.

Oak Creek begins north of the Farmland property, drains a large area on the property known as Oak Creek Islands, and joins the Peace

River south of the property. Stations SW-2, -6, -7, and -8 are located on Oak Creek with SW-6 and -7 in Oak Creek Islands. Stations SW-1 and -3 are on intermittent tributaries of Oak Creek that drain marsh areas during wet periods. Neither station had any measurable flow during the biological sampling, probably due to a thick growth of water hyacinths. Only stations SW-2, -6, -7, and -8 are considered to be in the Oak Creek system.

Stream flow velocities were low (0.0-1.7 feet per second) at all four stations; SW-2 never had any measurable flow. Dissolved oxygen values exhibited a wide range (0.1-10.2 mg/l) at Stations 2, 6 and 7. Station SW-8 had more moderate D.O. values with a low of 3.8 mg/l. All four stations had their highest D.O. values in January and lowest in the summer and early fall. Water temperatures ranged from 7.5 to 29°C at the four stations with the lowest temperatures recorded in January. The pH had similar values at all stations: a mean of 6.2 and range of 4.8-7.0.

The available substrate and associated macrophyte growth were unique at each station. SW-2 was dry in June 1977 but had a thick water hyacinth growth over a bottom of sand and mud when there was water. SW-6 was dry in June and July 1977; it had a sand, mud and detritus bottom and a thick overstory growth. SW-7 had a sand and gravel bottom with leaf litter from the overstory. SW-8 had sand, some detritus, and a thick overstory.

8.1.2 PHYTOPLANKTON

Phytoplankton collections were made by ESE on the Farmland mine site in March and May 1979 (Tables 8-7 and 8-8), with 80 species identified in the March samples and 91 species in the May samples. The numbers of species collected in individual systems are listed in Table 8-9. No significant difference among stream systems is evident.

Diatoms were the dominant taxon in all seasons based on total abundances. However, the Chlorophyta (green algae) typically had the most species in each collection.

8.1.3 MACROPHYTES

Macrophytes were sampled in several marshes and swamps near Hickory Creek and Oak Creek as part of the terrestrial vegetation surveys. These macrophyte data are included in the marsh and swamp data presented in Table 9-2. Macrophyte vegetation was not sampled at those sampling stations used for water quality, benthos, and fish sampling. However, qualitative observations of the macrophyte growth were made at the times of aquatic sampling. These observations are included in the physical characteristics of Tables 8-2 through 8-6 since macrophytes can provide additional substrate, reduce currents, and alter the dissolved oxygen and nutrient values of the water. Discussion of the effects of macrophytic growth on the benthic and fish biota are included in the following descriptions where appropriate.

8.1.4 BENTHIC MACROINVERTEBRATES

General Discussion

The benthic community is often sampled because its constituents can serve as indicators of environmental conditions. Benthic macroinvertebrates are especially useful in areas where stream flow and water quality parameters vary widely due to rainfall or temporary pollutional effects. In these situations the benthos may better reflect past rather than present water quality (Resh and Unzicker 1975). Within stream ecosystems benthic macroinvertebrates serve the important function as primary food source for fish predators. This role as prey is especially true of the numerous orders of insect larvae in the streams.

Several sampling techniques were used by ESE to sample benthic invertebrates on the Farmland site. These include the Ponar grab, core sampler, Hester-Dendy samplers, flotson grabs, dipnetting, and seining. Data from the Ponar grabs and qualitative grab samples are used throughout the following discussion of the benthic fauna because of their use at all stations over the entire study period. However, due to the different handling of Ponar samples, the density data (number/meter^2) are not presented. Instead, relative abundance categories of Abundant (greater than 25 percent of individuals collected at a station), Common (between 5 and 25 percent), Occasional (between 1 and 5 percent), and Rare (less than 1 percent) were applied to taxa collected in the Ponar samples. Presence/Absence information is provided by the qualitative grabs. Table 8-10 contains relative densities and presence of benthic organisms collected at each station. Table 8-11 shows the number of species collected by Ponar sampler at each station for each sampling period.

Description of Benthic Communities

Dominant Taxa. Three major groups of benthic invertebrates dominated collections made on the Farmland property. These were the oligochaetes--aquatic earthworms; dipterans--flies, midges, and mosquitoes; and molluscs--gastropods (snails) and pelecypods (mussels).

Oligochaetes were Abundant or Common at all stations (Table 8-10). As a group they typically constituted over 25 percent of the benthic organisms collected and at several stations accounted for over 50 percent. Oligochaetes, especially tubificids, often are associated with polluted water (Pennak 1978). However, the abundance of oligochaetes in the streams, marshes, and ditches should not be unexpected or alarming. Brinkhurst and Cook (1974) state that the quality and quantity of organic matter reaching the bottom appears to be more important than the chemical parameters of the water or sediment in determining the tubificid species composition. Most stations on the Farmland property had at least some organic detritus on the bottom (Tables 8-2 through 8-6).

Oligochaetes are not limited to polluted waters (Brinkhurst and Jamieson 1971), and further, the use of organisms not identified to species as water quality indicators is of questionable value (Resh and Unzicker 1975). It appears safe to say that the abundance of oligochaetes reflects a substrate rich in organic matter and water that is occasionally low in dissolved oxygen.

Over 70 taxa of dipterans were collected making this order of aquatic insects the best represented major group. _Bezzia_ sp., a biting midge, was found at all stations sampled in 1977-78. Chironomid (midge) larvae were Common or Occasional at practically all stations. They are frequently found together with oligochaetes in mucky bottoms and are able to withstand harsh conditions (Pennak 1978). Chironomid larvae are an important food for juvenile and adult fish. _Polypeldilum_ _halterale_ and _P_. _illinoense_ were the most common chironomids, and they are termed facultative or intolerant of organic wastes by Weber (1973). _Chironomus attenuatus_ was Common at many stations and is termed tolerant of organic wastes by Weber (1973).

Twenty-five taxa of molluscs were collected between June 1977 and May 1978 at stations SW-1 to SW-16. _Physa_ sp., a gastropod, and _Sphaerium_ sp., a pelecypod, were found at most stations. According to Pennak (1978), _Physa_ sp., a pulmonate snail, occurs in greatest abundance where there is a moderate amount of aquatic vegetation and organic debris. Many pulmonate snails come to the surface of the water periodically for air; however, certain species of _Physa_ never come to the surface for air. One species of _Physa_ was found to tolerate dissolved oxygen levels of less than 2.0 mg/l (Pennak 1978). _Sphaerium_ sp. is found in a wide range of conditions including low pH and low levels of bound CO_2 (both needed for shell construction). Also, many Sphaeriidae are known to burrow into the substrate at times of drought (Pennak 1978). This tolerance to desiccation would be valuable to organisms living in the small, intermittent streams found on the Farmland property.

Seasonal Trends. The most obvious seasonal trend is the wet and dry hydroperiod that causes some sampling stations to become dry. Stations were dry in June and July 1977, and April and May 1978. It appears that the drying of some stations results in more species being collected in those areas not dry. Fewer species were collected during the summer 1977 at most stations, but no clear seasonal trend can be established because of the large standard deviations associated with mean species' numbers.

Differences Among Systems. No significant differences among stream systems or their sampling stations can be determined. This inability is due to the different sampling techniques used, different numbers of collections, and large standard deviations associated with the data.

The benthic macroinvertebrate data from the streams, marsh, and ditches are typical of harsh, unstable environments. The dominant taxa are all able to tolerate the periodically low dissolved oxygen and alternating wet and dry hydroperiod. The overall dominance of the oligochaetes reflects a bottom with substantial amounts of organic debris.

8.1.5 FISH

General Discussion

The fisheries resources of the Farmland property are probably the most important component of the aquatic biota from a recreational and aesthetic viewpoint. A few species collected are of recreational importance, but most are forage fish--feeding on insects, detritus, and periphyton and in turn being preyed upon by the larger species. A variety of fish have been collected in recent years on the Farmland property or in the Peace River adjacent to it. Table 8-12 lists fish that were reportedly collected in the Peace River by Ware (1969) and Chapman (1973) in addition to those collected by ESE from 1977 through

1978 in aquatic surveys of the stream systems on or adjacent to the Farmland property.

From June 1977 through May 1978, fish were collected in the Peace River and in streams, marshes and canals on the Farmland site. Two sampling techniques were used: seine and dipnet. Seining was the preferred technique, but where macrophytes such as water hyacinth choked the channel or water levels were too low, dipnetting was the method used.

A total of 23 species were collected on or adjacent to the Farmland property from June 1977 to May 1978. Most species had only a few individuals, while two species of the Poeciliidae (livebearers) family were ubiquitous in distribution and dominated all other species. The mosquitofish, (Gambusia affinis) and the least killifish (Heterandia formosa) together comprised over 68 percent of all fish collected. Further, of all collections that had at least one fish, 97 percent contained the mosquitofish and 62 percent, the least killifish.

The mosquitofish and least killifish are successful species in the streams, marshes, and canals because of their tolerance of the fluctuating and stressful conditions of their habitat as described earlier. The mosquitofish is tolerant of waters with low dissolved oxygen and low pH. It is small--less than two inches--and is therefore able to invade areas temporarily inundated. The mosquitofish forages primarily on mosquito larvae which hatch readily when the eggs are covered with water. The least killifish is smaller than the mosquitofish and prefers quiet waters having protective vegetation. It feeds on insect larvae, crustaceans and algae (McLane 1955).

Several commercial and game fish species were also collected: white catfish (Ictalurus catus), brown bullhead (Ictalurus nebulosus), bluegill (Leponis macrochirus), largemouth bass (Microptus salmoides), spotted sunfish (Lepomis punctatus), and redear sunfish (Lepomis microlophus). Four of the species are in the Centrarchidae (sunfishes) family which is well represented in Florida because most of its species inhabit quiet, well-vegetated waters (Layne, et al. 1977). Three species were collected that are termed biologically significant (Layne, et al. 1977) because they are indicative of clean water. These were the coastal shiner (Notropis petersoni), redeye chub (Hybopsis harperi), and brook silverside (Labidesthes sicculus). Tables 8-13 through 8-22 list those species collected June 1977 through May 1978. These data are compiled and presented by stream system in Table 8-23.

Stream Systems

Peace River. The Peace River is the only system sampled as part of the Farmland site investigations which was also sampled by other investigators. Ware (1969) studied the river following a slime pond spill in March 1967, and Chapman (1973) studied the Peace River following a similar spill in December 1971. Chapman found 35 taxa of fish, most of which are freshwater species, but several are estuarine or marine species.

The Peace River acts as a population reservoir for the intermittent streams draining into it. Of the 35 taxa collected by Chapman (1973), 24 taxa were collected in the surveys of the stream systems on the Farmland property. Twelve species were collected during June 1977 through May 1978 in the River. The hogchoker (Trinectes maccelatus), an estuarine species, was the only species collected in the Peace River but not in any other stream.

Troublesome Creek. Only nine fish species were collected in Troublesome Creek during one year of sampling--the fewest of all the stream systems. Yet, Troublesome Creek was the only stream found to contain perennially flowing water. All of the species found were also collected in at least one other system.

Hickory Creek. Hickory Creek is an intermittent stream where three out of four of the sampling stations were dry at some time during the sampling year. Despite that, 15 species were collected in the creek. The redeye chub, a biologically significant species indicative of clean water, was collected only in Hickory Creek. However, it was found at SW-14 only 1,500 feet from the Peace River from which it probably came. Largemouth bass and the bluegill, recreational species, and white catfish, a commercial species, were also among those fish collected.

Oak Creek. Oak Creek drains a large area including Oak Creek Islands in the center of the Farmland property. Twelve species were collected at its four stations over a year's time. The bluegill sunfish, a recreational species, and the white catfish, a commercial species, were collected in the creek. Missing from collections in Oak Creek were the cyprinids or minnows which are indicative of clean water.

Endangered and Threatened Species - Fish

In May 1980, EPA provided the U.S. Fish and Wildlife Service (U.S. F&WS) Jacksonville, Florida office with a description of the proposed Farmland project and requested a list of endangered and threatened species which might occur in the project's area of influence. U.S. F&WS responded to the EPA's request with a listing of species believed to be present in the area (U.S. F&WS 1980). No fish were among the species listed.

The Florida Game and Freshwater Fish Commission (1979) and Florida Committee on Rare and Endangered Plants and Animals (Gilbert 1978) also list species considered to be endangered, threatened, or rare in Florida. None of the fish species listed by these organizations were found during sampling efforts in streams on the Farmland property or in the Peace River adjacent to the property.

8.2 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

The proposed mining and processing of phosphate rock at the Farmland site and subsequent reclamation of disturbed land will result in adverse impacts on the existing aquatic ecology of the site. This section contains a description of the impacts on aquatic ecology associated with the alternative methods of accomplishing the identified project goals. The discussion is arranged by project component so that the alternative methods for any given project component can be examined to an equal degree, thus providing a basis for comparison of alternatives. The first alternative discussed under each project component is Farmland's proposed action (Section 2.0). Only those components having impacts relating to aquatic ecology are considered in this section. The last discussion within the section considers the aquatic ecology impacts of the no action alternative as it applies to the project as a whole.

8.2.1 MINING

Dragline Mining (Farmland's Proposed Action)

The potential effects of Farmland's proposed mine on the site's aquatic ecosystem are discussed in this section. The effects of four impact-producing actions--destruction of aquatic habitat, alteration of stream flow, turbid runoff, and effluent discharge--are described.

Destruction of Aquatic Habitats. Over 1 mile of Hickory Creek streambed will be destroyed due to mining during years 12-14 (Figure 8-2). As a result, all animals that were not able to escape, all aquatic plants, and the physical features that constitute the aquatic habitat will be destroyed. The total loss of aquatic habitat in this area will be temporary, since reclamation plans call for the restoration of existing flows following mining (see 8.2.4 RECLAMATION). Flow is scheduled to be returned to the area 4 years after mining is complete.

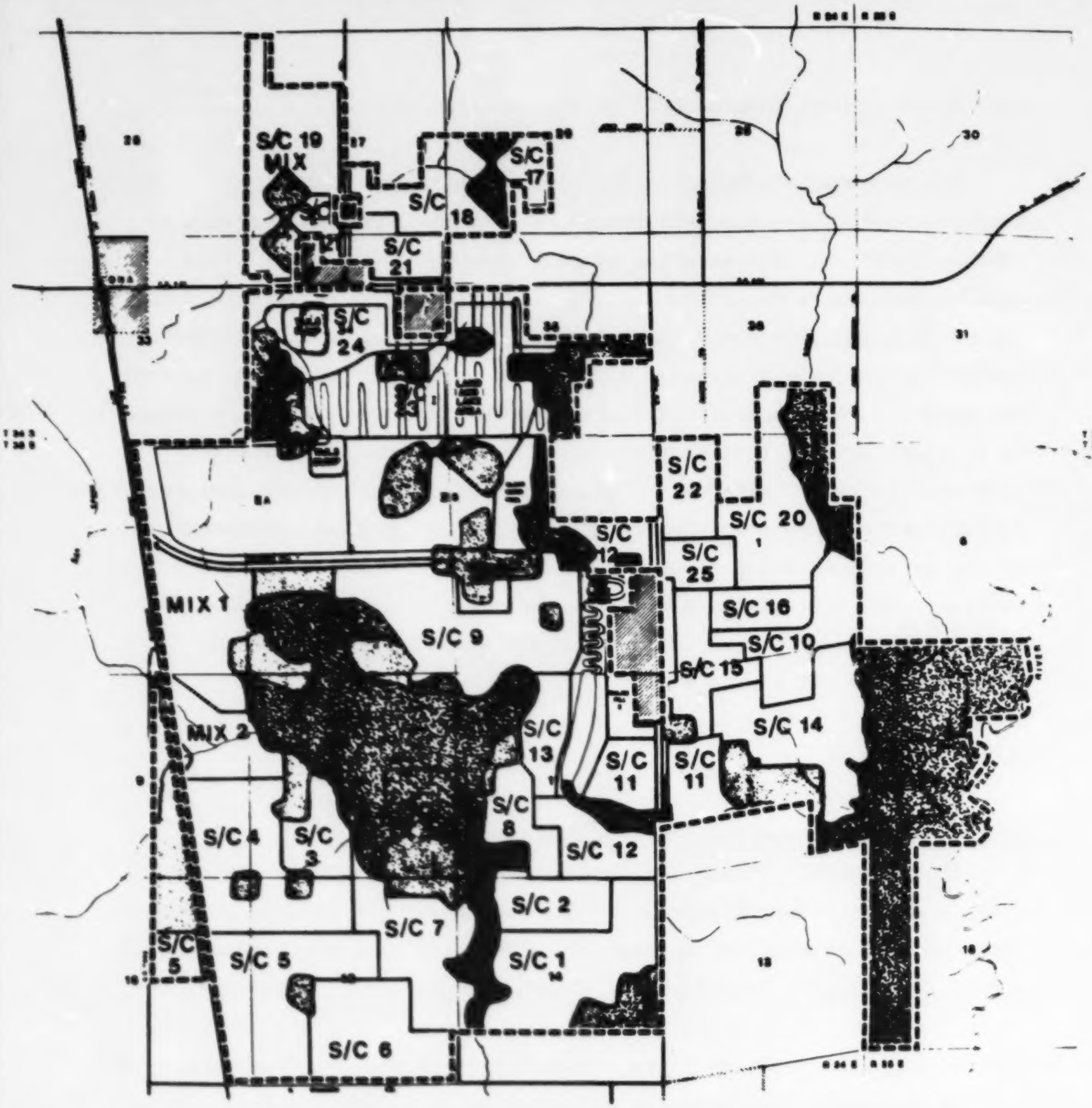


FIGURE 8-2. MINING SEQUENCE MAP.

▭	OUT PARCEL (NOT FARMLAND PROPERTY)
■	UNMINEABLE AREA ENVIRONMENTAL SENSITIVITY
▭	UNMINEABLE AREA MINE PLANNING
S/C 10	SAND CLAY MIX AREA DESIGNATION
MIX 1	SPECIAL SAND CLAY MIX AREA Dredged Clay Fill Allowing For Final Settling Near Original Elevation.
S/C 19 MIX	SPECIAL SAND CLAY MIX AREA Dredged Clay Fill Allowing For Final Settling To Be Approximately 4 Feet Above Original Elevation.

N

0 2,000 4,000

SCALE IN FEET

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

Oak Creek will be only minimally affected through the destruction of aquatic habitat since only short sections of the creek will be mined in years 4 and 10, and diversion channels will return water to Oak Creek immediately downstream of the mining activity, thus assuring normal stream flow into Oak Creek Islands. The portion of the creek mined in year 4 is scheduled to be reclaimed by year 10; the area mined in year 10 is scheduled to be reclaimed by year 15. The loss of aquatic habitat which will result from mining will also be temporary, since reclamation plans call for the restoration of existing flows following mining (see 8.2.4 RECLAMATION).

Dragline crossings of Oak Creek are scheduled to be made during the dry season and at only one location. Therefore, little aquatic habitat will be lost, and only minor downstream turbidity should result.

Alteration of Stream Flow. Stream flow reductions resulting from mining (see section 7.2.1) may result in the loss of fish and invertebrates that become concentrated in the remaining pools and wet streambed. In addition, the macrophyte abundance could be reduced, resulting in a loss of habitat for fish and invertebrates. The severity of the effect of flow reductions depend on the season in which they occur. Hickory Creek, which will be most affected by flow reduction, is already an intermittent stream. The plants and animals of such systems are very adaptable to naturally changing water levels (Berra and Gunning 1970; Crossman, et al. 1974; Larimore, et al. 1959). If flow reductions occur during a time of no stream flow, the fish will have moved downstream or into the remaining pools. The insect larvae may have increasingly become part of the drift as the flow slows (Minchall and Winger 1968); oligochaetes and molluscs will attempt to penetrate into the moist bottom but will be lost from the area that is mined. However, if stream flow is drastically reduced at a time of high flow, the fish and invertebrates will not have an opportunity to move out of the area and may become stranded as was observed by Kroger (1973). Because of the natural resiliency of the local fish, macroinvertebrates and macrophytes, effects of the stream flow reduction on these organisms are judged to be temporary and minimal--lasting from 1 year in Oak Creek to 4 years in Hickory Creek.

Turbid Runoff. A potential for turbid runoff reaching aquatic habitats will exist during land clearing and operation of the mine. The ecological effects of high levels of suspended solids or turbidity on aquatic organisms are described by Cairns, et al. (1972) as: (1) clogging or irritation of gills; (2) blanketing or sedimentation; (3) loss of light penetration; (4) adsorption and/or absorption of various chemicals; and (5) availability as a surface for growth of microorganisms. But turbidity does not persist for long distances downstream nor does it remain in the water at the discharge (Burns 1972; Barton 1977). Further, fish can either avoid high turbidity levels or can withstand them for short periods (Ritchie 1972). Although some increases in turbidity are expected, impacts on aquatic organisms due to the discharge of turbid water are judged to be temporary, and the probability of the release of any highly turbid water is small. However, some discharge of moderately turbid water is not unexpected.

Dredge Mining

The impacts associated with the destruction of aquatic habitat described above for dragline mining would also be expected with dredge mining. The use of dredge mining would, however, reduce the flow reduction impacts resulting from dewatering. Dredge mining would require that water levels be maintained in the active mining area, thus the surrounding Surficial Aquifer and its contributions to the base flow of adjacent creeks would be maintained. However, there would be an increased possibility for the release of turbid water into surface waters because of the greater amount of such water that would have to be handled and stored.

Bucketwheel Mining

Bucketwheel mining would result in impacts on aquatic ecology similar to those described for dragline mining.

8.2.2 WASTE SAND AND CLAY DISPOSAL

Sand-Clay Mixing (Farmland's Proposed Action)

Farmland proposes to dispose of most of the waste sand and clay through the sand-clay mix technique. Separate sand and clay disposal areas will also be required, with waste clays to be impounded in diked areas covering 1078 acres during most of the life of the mine. These large areas will contain clays at various densities, ranging from about 17 percent solids to less than 3 percent solids. Should a dike failure occur in an impoundment dike, this material could flow into natural stream courses and produce tremendous impacts on aquatic biota. A worst-case analysis of the result of a dike failure in one of Farmland's proposed impoundments (Area I, the largest undivided settling area proposed) indicates that as much as 11,500 acre-feet of material could be released, most of which would find its way into Oak or Hickory Creeks (Farmland 1979).

Such breaks have occurred along the Peace River in the past. In March 1967, 1500 acre feet of phosphatic clays entered the Peace River near Ft. Meade. A study of the effects revealed that 90 percent of the fish and most of the macroinvertebrates except for oligochaetes and chironomid larvae were killed by mechanical suffocation (Ware 1969). A similar slime pond spill in December 1971 of over 3000 acre feet of clays into Whidden Creek resulted in greater than 90 percent loss of fish and a significant loss of macroinvertebrates (Chapman 1973). Both spills occurred upstream of the Farmland property, but effects would most likely not be seen in the samples collected in 1977-78 by ESE. Recovery of the fauna was judged to be rapid in both spills (Ware 1969, Chapman 1973).

Because the sand-clay mix should dewater and consolidate more rapidly than separately impounded clays, most of the wastes confined in the sand-clay mix disposal areas should not be in a fluid state. The area affected by a break in a sand-clay retention dike should, therefore, be relatively small.

Conventional Sand and Clay Disposal

Conventional sand and clay disposal would result in the creation of about 2700 acres of separately impounded clays during the life of the mine (compared to about 1200 with Farmland's proposed technique). This would result in the creation of additional retention dikes and thus increase the probability of a dike failure which would have tremendous impacts on aquatic biota. The large clay settling areas used in conventional clay disposal would consume water via adsorption and evaporation thus reducing the need to discharge excess water to surface waters. Conventional clay disposal might also result in a reclamation plan that would create more acres of lakes on the site, thus increasing the amount of aquatic habitat over that which will result from the proposed action.

8.2.3 PROCESS WATER SOURCES

Groundwater Withdrawal (Farmland's Proposed Action)

The major source of water for the proposed mine will be from onsite deep wells. The production wells will be drilled to an approximate depth of 1400 feet and cased to about 250 feet. Since the drawdown which results from pumping must meet the requirements of the Southwest Florida Water Management District, the operation of these wells should have little impact on the surrounding aquatic habitats.

Surface Water Impoundment

The creation of surface water impoundments for the storage of runoff from the site for use as process water would provide more than

1000 acres of lacustrine habitat. However, the intermittent creek ecosystems within areas of Oak Creek Island to be preserved under the proposed action would be cleared for reservoir construction. Also, downstream sections of Hickory and Oak Creeks would no longer receive normal flood flows resulting in a shift in species composition from those plants and animals tolerant of flooding and dessication to those needing more stable conditions.

8.2.4 RECLAMATION

Farmland's Proposed Reclamation Plan

Farmland's proposed reclamation plan is designed to restore surface flows (and thus aquatic habitats) to areas as soon as practicable after mining is complete. Hickory Creek will be mined during years 12-14, while Oak Creek will be mined in years 4 and 10.

Farmland indicates that flow will be returned to the current Hickory Creek channel area in year 16, 4 years after mining within the area begins. A lake system will be created through which Hickory Creek will be rerouted, as shown in Figure 8-3. The upper portion of this 140-acre area will consist of a series of finger lakes which form a meandering channel for the creek. The lower portion of the lake system will consist of an open lake about 600 feet wide and 3000 feet long created by double spoiling the parallel mine cuts adjacent to this area. The lake system will intercept the undisturbed portion of the Hickory Creek channel at an elevation of approximately 65 feet MSL which will serve as the outfall into the natural floodplain at this point and establish the water level in the entire lake system. Figure 8-3 provides a cross-sectional view of the water and lake surfaces for the lake system. Overburden from the spoils in the finger lake portion of the area will be graded into the mine cuts to conform to slope requirements, fill in the cuts to establish a maximum water depth of 15 feet, and form a 50-foot wide littoral zone on one side of the lake as shown in Figure 8-4. In the open water lake in the lower portion of the area, the

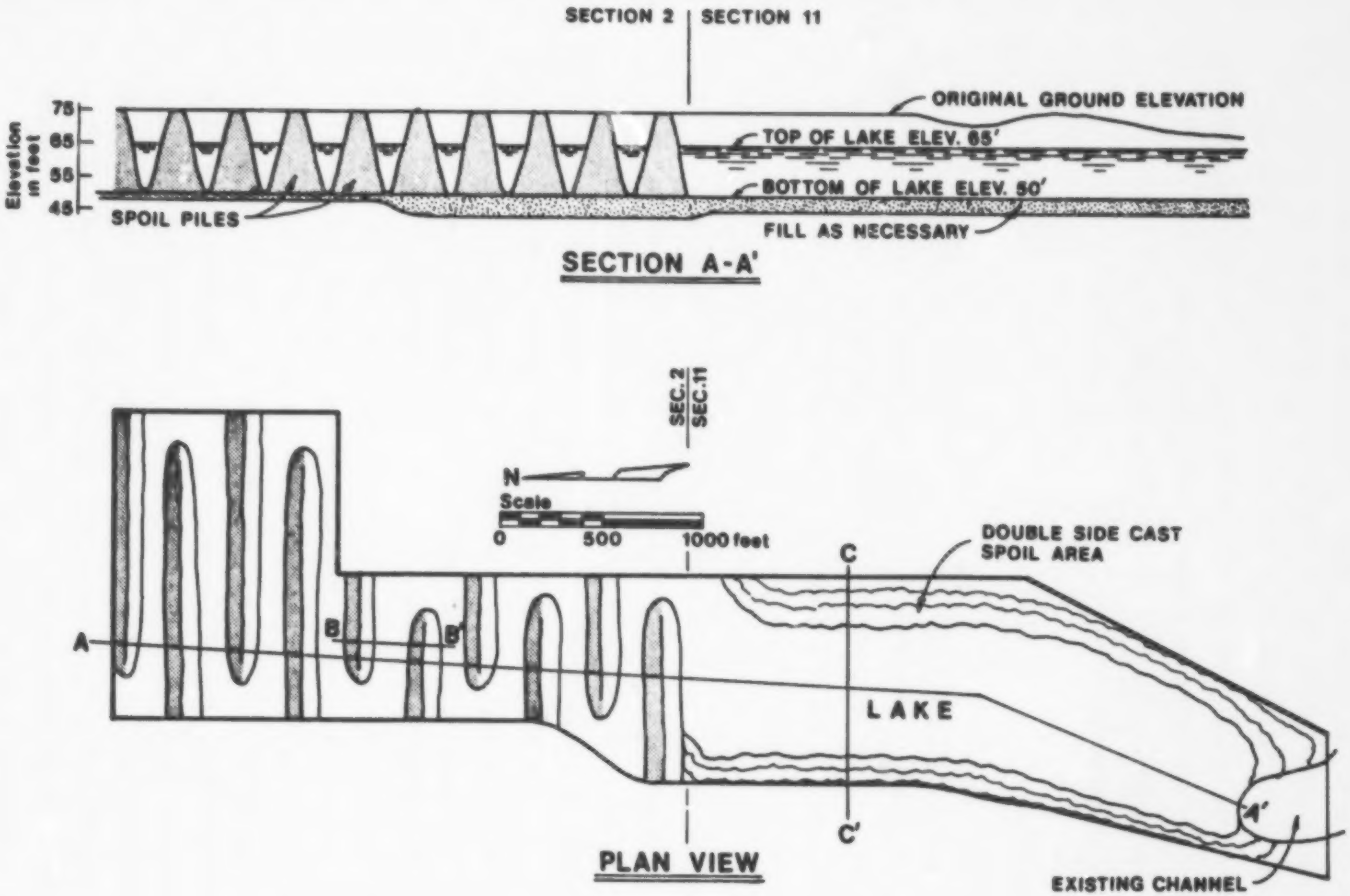
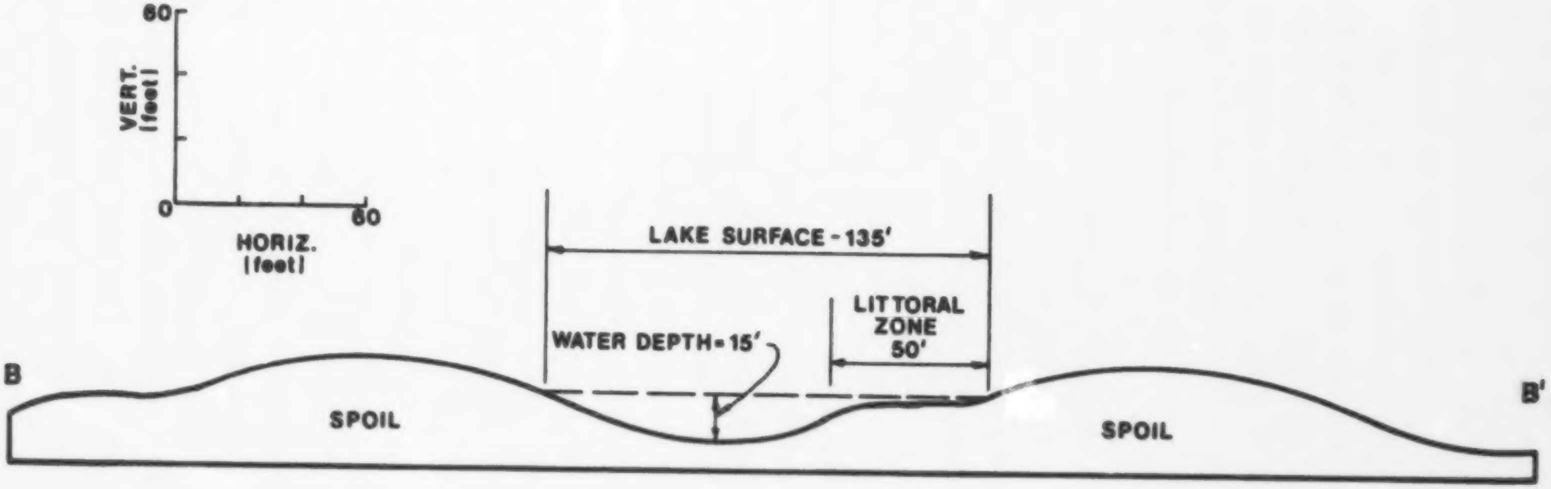


FIGURE 8-3. PHYSICAL CHARACTERISTICS OF THE LAKE SYSTEM TO BE CREATED BY RECLAMATION IN SECTIONS 2 AND 11, T35S, R24E OF THE MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979



SECTION B-B'

FIGURE 8-4. PHYSICAL DESIGN CONCEPTS FOR FINGER LAKE RECLAMATION AREA IN SECTION 2, T35S, R24E, OF THE MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

double spoil piles on the east side will be graded into the mine cut to form a 100-foot wide littoral zone approximately 1-3 feet deep as shown in Figure 8-5. On the west side of the mine cut, only a single spoil pile will be available to provide overburden fill for the mine cut. Tailings sand will, therefore, be used to supplement the fill on this side of the mine cut in order to establish a 12 to 1 slope out of a depth of 15 feet. When reclamation is complete, the area will be approximately equally divided between water and land surface.

Farmland proposes to use special techniques to restore the area through which the flow of Oak Creek and one of its northern tributaries will be restored. After the mining of this area, levees approximately 11 feet in height will be constructed around these areas and they will be filled with sand-clay mix to an average height of about 6 feet above natural grade. In order to speed up the subsidence, and thereby allow reclamation of these environmental restoration areas to proceed at a more rapid pace, clays dredged from Settling Area I are planned to be used in the sand-clay mix deposited here. Dredged clays will enter the landfills at approximately 18 percent solids as opposed to 4 percent solids for clays used in normal sand-clay landfills. The thickened clays will promote more rapid consolidation of these landfills. Subsidence will bring the special mix areas to near original grade on the average, but greater subsidence where the sand-clay fill is the thickest will result in the center of the filled mining cuts being slightly below grade as shown in Figure 8-6. This gradually sloping land around the protruding spoil piles will in effect create a broad swale approximately 150 feet wide and resembling a natural floodplain. As shown in Figure 8-7, spoiling patterns will run east-west in Special Mix 1 and north-south in Special Mix 2 so that a meandering floodplain will be created for each of the restored creek channels. This arrangement will provide maximum area in the restructured floodplains for providing the water retention and nutrient assimilation functions characteristic of such areas. The spoil piles will be graded and the entire area revegetated prior to introduction of flow-through water into the areas.

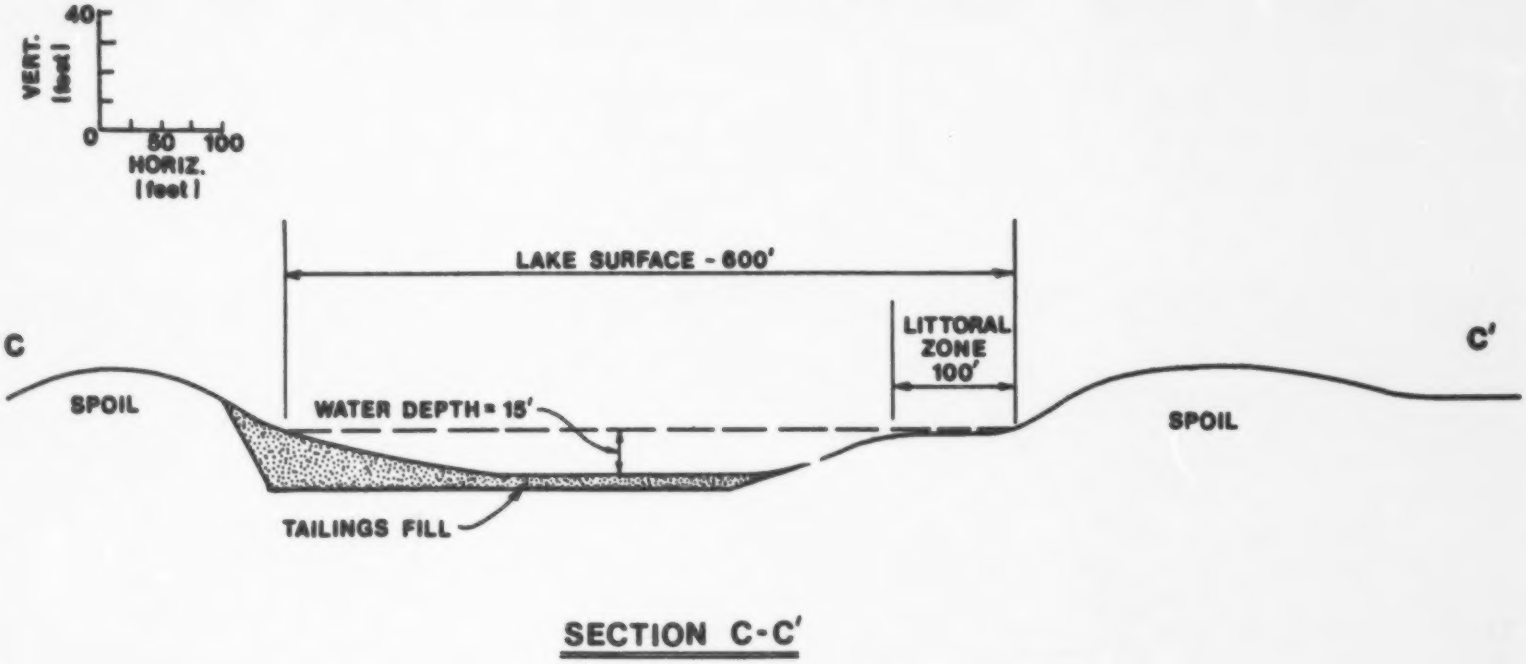


FIGURE 8-5. PHYSICAL DESIGN CONCEPTS FOR THE OPEN LAKE RECLAMATION AREA IN SECTION 11, T35S, R24E, OF THE MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

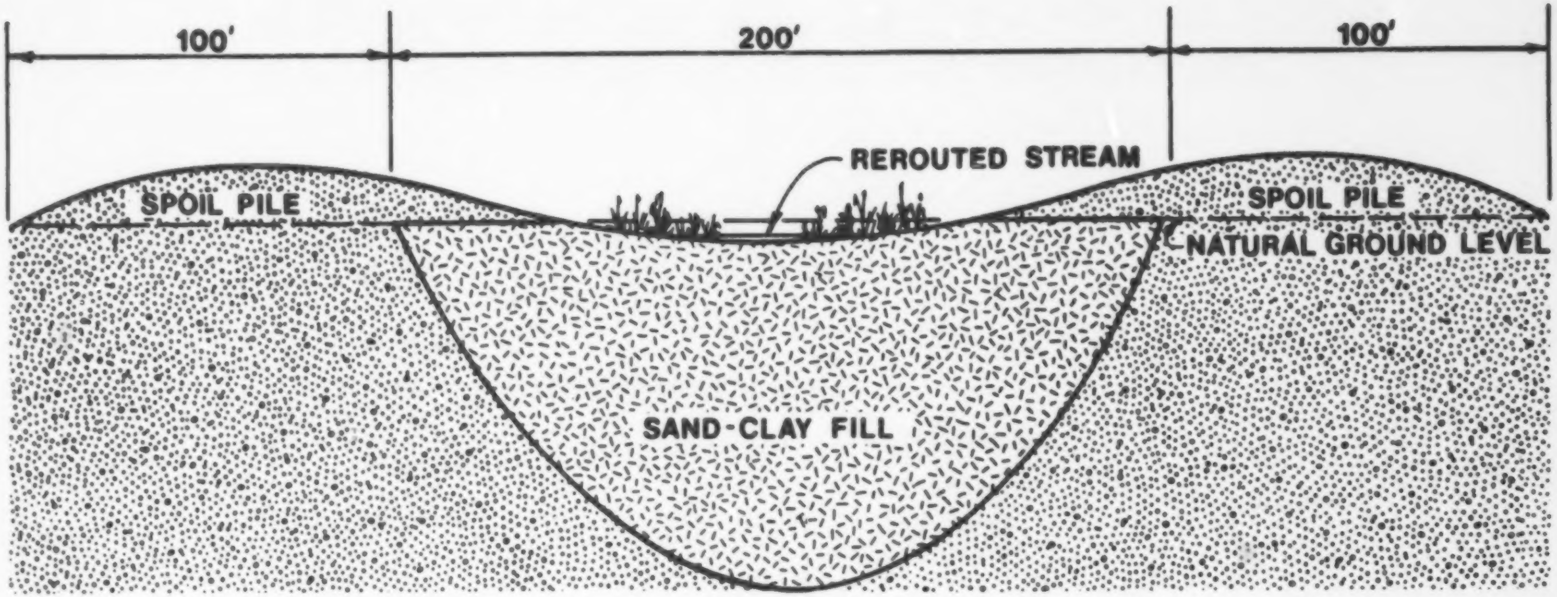


FIGURE 8-6. CROSS-SECTIONAL VIEW OF SPECIAL SAND-CLAY LANDFILLS SHOWING CREATION OF BROAD FLOODPLAIN AND MARSHES BY SUBSIDENCE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

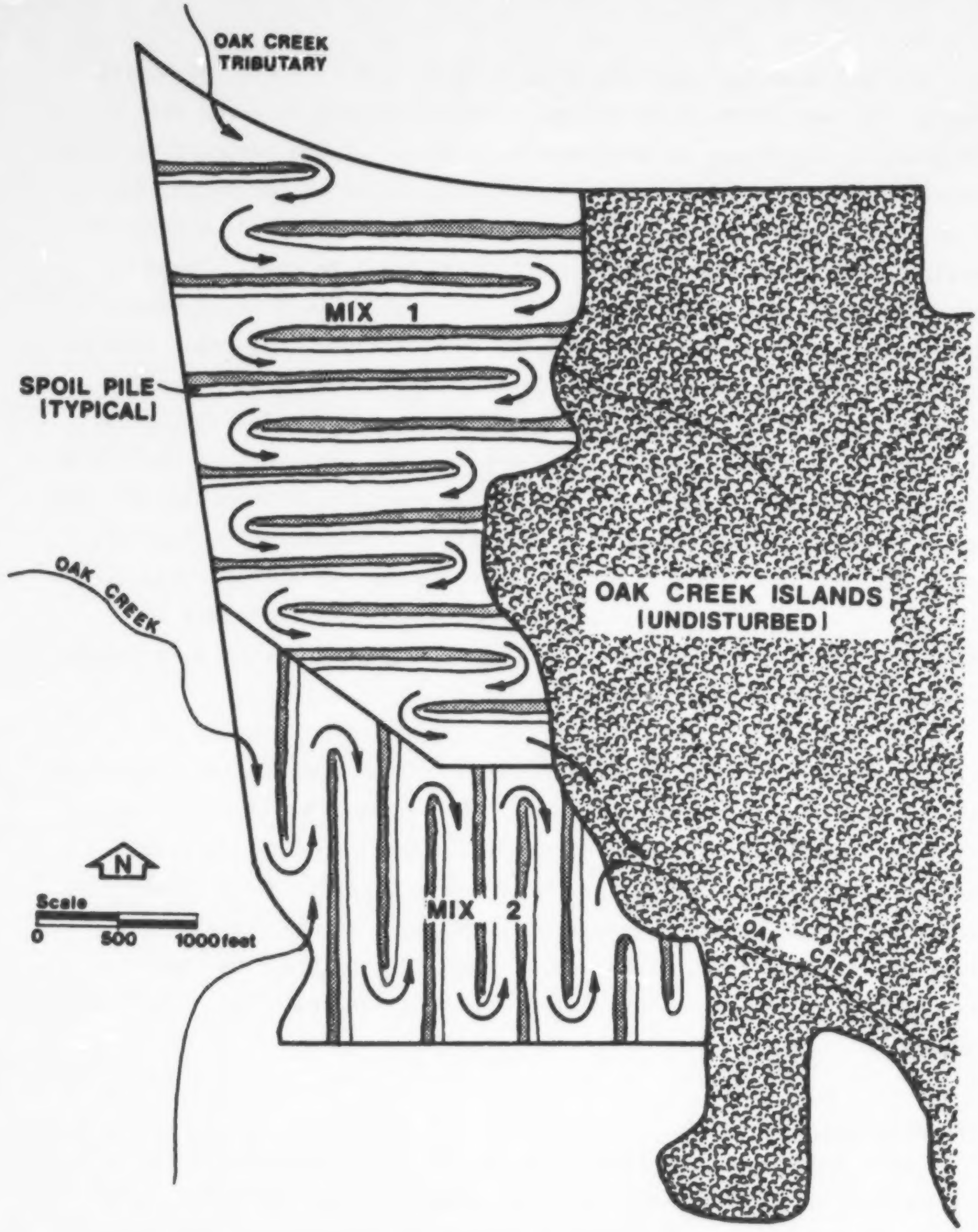


FIGURE 8-7. SPOIL PATTERNS IN SPECIAL SAND-CLAY AREAS TO CREATE A MEANDERING FLOODPLAIN FOR THE RESTORED PORTIONS OF OAK CREEK.

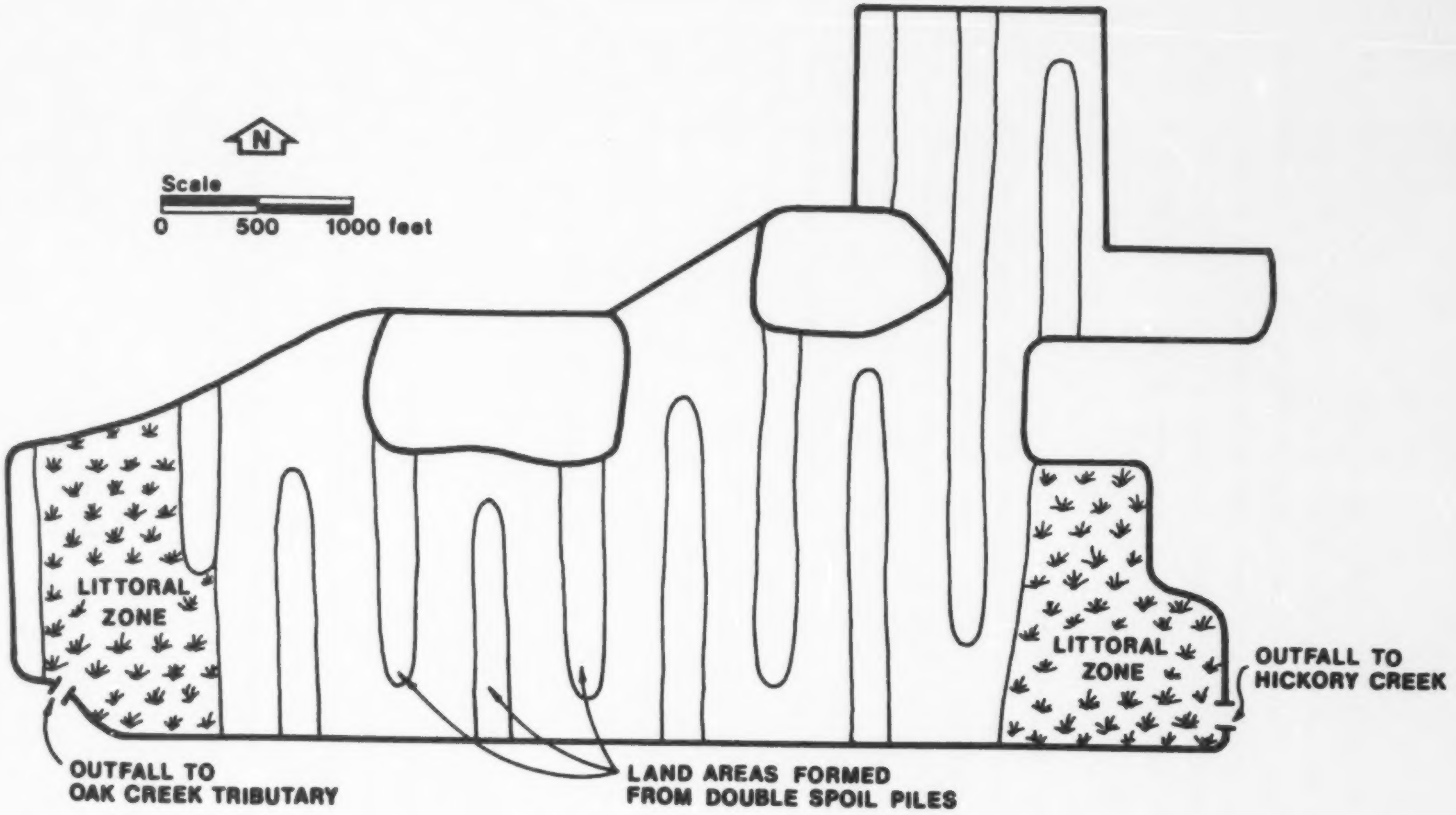
SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

A final land and lake area will be created as a result of mining during the last years of operation. Double spoiling patterns will be utilized in the mining of this area in order to create concentrated land areas. Topography in the area is such that inflow to the lakes will be from the northwest and that lake outfalls could be located in both the southwest and southeast corners of the land and lake area. These outfalls could exit to a tributary of Oak Creek or to Hickory Creek, respectively. As shown in Figure 8-8, extensive littoral zones will be created by grading the overburden in the vicinity of these outfalls. Weirs will establish and maintain the lake outfall levels. All other spoil piles in this area will be graded into the mine cuts to conform to slope requirements. Mining depths and the groundwater table in the area are such that grading of spoils will achieve a maximum water depth of about 15 feet. Of the 368 acres included in this area, approximately 50 percent of the total surface area will be covered by water and 50 percent by land. Reclamation, including revegetation, will be completed within 3 years after completion of mining.

As the aquatic habitats described above are created, recolonization by aquatic biota will begin to occur. Periphyton will likely be the first to recolonize, followed by insect larvae, macrophytes, fish (especially Gambusia affinis and Heterandria formusa) and mollusks (Crossman, et al. 1974). Some studies (e.g., Larimore, et al. 1967; Gunning and Berra 1969; Berra and Gunning 1970) suggest that such recolonization may proceed rapidly, but the actual rate which will occur cannot be stated.

Conventional Reclamation

The aquatic habitats created by conventional reclamation (i.e., reclamation of separate sand and clay disposal areas and mined land) would consist largely of lake areas scattered throughout those areas of the site not covered with impounded clays. Assuming that one half of these areas on the Farmland site were reclaimed as lakes, their combined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Scale
0
500
1000 feet
LITTORAL ZONE
LITTORAL ZONE
OUTFALL TO HICKORY CREEK
OUTFALL TO OAK CREEK TRIBUTARY
LAND AREAS FORMED FROM DOUBLE SPOIL PILES

FIGURE 8-8, PHYSICAL CHARACTERISTICS OF THE LARGE LAND AND LAKE AREA IN SECTIONS 34 AND 35, T34S, R24E, OF THE MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

acreage would be about 1000 acres. This would provide nearly four times the lacustrine habitat that will be created by Farmland's proposed reclamation plan. However, conventional reclamation would not result in the creation of meandering channels and marsh areas that are part of Farmland's proposed plan, for most of the site (about 2700 acres) would be covered with settled clay to an elevation of about 35 feet above existing grade.

Natural Mine Cut Reclamation

With natural mine cut reclamation, mined out areas of the site would be left ungraded. The resultant topography would be very uneven, comprised of overburden windrows and furrows. Water accumulating in these furrows would form many interconnected channels and pools, creating a diverse shallow-water aquatic habitat. The depth of these water areas would be dependent upon the type of waste disposal technique used during the operation of the mine. If sand-clay mix were placed into the furrows (as Farmland proposes to do) the depth would be less than if sand and clay had been disposed of by conventional methods (i.e., separately). In either case, filling of these habitats would occur over time because of sedimentation and plant succession. The result would be a change from open water habitat to marsh and swamp habitat.

8.2.5 THE NO ACTION ALTERNATIVE

Under the no action alternative the aquatic environment with its alternating hydroperiod and tolerant organisms is expected to remain essentially as described in Section 8.1; however, succession of marshes into bayheads, etc. will modify some aquatic habitats in time. Also, any long-term change in rainfall patterns could affect aquifer levels and result in a shift in the existing plant and animal communities.

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Table 8-1. AQUATIC SAMPLING STATION LOCATIONS

System	Station Number
Peace River	SW-15, SW-16
Troublesome Creek	SW-11, SW-12
Hickory Creek	SW-4, SW-9, SW-13, SW-14
Oak Creek	SW-2, SW-6, SW-7, SW-8
Marsh	SW-1
Ditch/Canal	SW-3

Note: Stream systems are listed as encountered east to west; station numbers are listed from upstream to downstream.

Table 8-2. PHYSICAL CHARACTERISTICS OF THE PEACE RIVER.[1]

						1977	1978				
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
SW-15; BOTTOM: Sand, some mud												
Water Temp (°C)	28.2	27.0	28.5	29.0	24.0	18.0	20.0	11.0	10.5	20.5	25.0	26.5
D.O. (mg/1)	9.0	5.4	6.1	5.5	5.8	9.0	9.1	9.7	9.4	8.8	7.0	7.7
Percent Oxygen Saturation	115	68	79	72	69	95	100	88	84	98	85	96
pH	6.4	5.7	6.0	7.2	5.9	6.8	6.2	6.2	6.0	6.9	7.1	7.1[2]
Turbidity (NTU)[2]	1.5	3.9	5.5	1.9	1.0	0.5	3.5	2.4	1.4	2.4	1.4	2.5
SW-16; BOTTOM: Sand, some mud, macrophytes adjacent												
Water Temp (°C)	30.0	27.5	28.5	30.0	22.5[2]	18.0	20.0	11.0	10.0	20.5	25.0	26.5
D.O. (mg/1)	9.6	5.9	6.3	5.6	-	9.3	9.2	9.7	9.8	8.8	7.0	7.7
Percent Oxygen Saturation	127	75	81	75	-	98	101	88	87	98	85	96
pH	7.3	6.2	6.3	5.4	7.2[2]	6.7	6.3	6.2	6.8	6.9	7.4	7.5[2]
Turbidity (NTU)[2]	1.1	3.5	3.6	5.4	1.3	0.5	0.5	2.3	2.0	2.8	2.4	2.7

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[1] ESE water quality data (unpublished).

[2] P.E. LaMoreaux & Associates, Farmland Monitoring Report.

Table 8-3. PHYSICAL CHARACTERISTICS OF TROUBLESOME CREEK.[1]

							1977	1978				
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
SW-11; BOTTOM: Sand, some detritus												
Water Temp (°C)	27.5	25.0	27.0	28.0	25.0	19.5	19.0	10.0	11.0	17.8	22.5	26.0
D.O. (mg/1)	4.9	-	6.3	5.2	6.8	8.4	8.4	9.5	10.0	9.7	8.4	7.8
Percent Oxygen Saturation	63	-	79	67	83	91	91	84	91	102	97	96
pH	6.8	6.3	5.8	6.2	6.9	6.8	7.1	7.5	7.1	6.6	6.7	6.9[2]
Turbidity (NTU)[2]	0.4	1.7	2.9	0.8	0.6	0.8	1.3	1.6	1.3	0.4	1.2	0.8
SW-12; BOTTOM: Mud, leaf litter, some sand												
Water Temp (°C)	26.5	28.0	28.0	27.0	25.0	18.0	18.5	10.5	11.0	17.2	23.0	24.0
D.O. (mg/1)	5.3	-	4.5	6.2	5.9	8.4	8.4	9.1	9.8	9.9	6.2	6.3
Percent Oxygen Saturation	66	-	57	78	72	89	90	82	89	103	73	75
pH	6.0	6.2	5.7	5.5	7.0	6.7	6.8	7.3	7.0	6.7	6.5	6.5[2]
Turbidity (NTU)[2]	1.0	2.0	1.0	0.8	0.7	0.8	1.2	12.	1.3	1.0	1.4	0.6

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[1] ESE water quality data (unpublished).

[2] P.E. LaMoreaux & Associates, Farmland Monitoring Report.

Table 8-4. PHYSICAL CHARACTERISTICS OF HICKORY CREEK.[1]

	June	July	Aug	Sept	Oct	Nov	1977 Dec	1978 Jan	Feb	Mar	Apr	May
					SW-4; BOTTOM: Sand, some detritus							
Water Temp (°C)	DRY	28.0	27.0	27.0	26.5	20.0	22.0	7.0	6.5	21.0	DRY	DRY
D.O. (mg/1)	-	4.6	2.3	2.7	0.2	7.7	7.0	12.2	8.9	8.5	-	-
Percent Oxygen Saturation	-	59	29	34	2	85	80	100	73	95	-	-
pH	-	5.8	5.1	6.2	7.3	6.1	6.5	6.3	7.3	6.2	-	-
Turbidity (NTU)[2]	-	1.4	1.4	0.7	0.7	0.8	0.4	0.7	0.6	0.9	-	-
					SW-9; BOTTOM: Sand, some detritus							
Water Temp (°C)	DRY	27.0	26.0	26.0	28.0	21.5	22.0	8.0	14.5	20.0	DRY	DRY
D.O. (mg/1)	-	-	2.1	2.4	0.4	7.3	6.8	11.5	9.1	7.4	-	-
Percent Oxygen Saturation	-	-	26	30	5	83	78	97	89	82	-	-
pH	-	6.0	5.2	6.4	6.5	6.1	5.8	6.7	6.2	6.5	-	-
Turbidity (NTU)[2]	-	1.6	2.6	0.8	1.4	3.0	0.6	0.8	0.8	0.6	-	-
					SW-13; BOTTOM: Sand, some gravel							
Water Temp (°C)	32.0	24.6	27.0	27.5	26.0	20.0	21.5	11.0	9.0	21.5	25.0	33.0
D.O. (mg/1)	5.9	6.1	6.7	6.6	5.8	9.1	9.3	10.2	11.0	8.2	3.4	10.0
Percent Oxygen Saturation	81	74	85	84	72	100	105	92	95	93	41	140
pH	6.6	5.5	5.3	5.2	5.9	6.5	6.1	7.4	6.7	6.3	6.6	6.8[2]
Turbidity (NTU)[2]	4.2	1.3	3.3	1.1	0.6	2.0	1.4	1.3	1.1	0.8	6.5	0.6
					SW-14; BOTTOM: Sand, some mud, detritus							
Water Temp (°C)	DRY	28.0	27.0	31.0	26.0	20.5	19.0	12.0	9.0	21.5	25.0	33.0
D.O. (mg/1)	-	7.0	7.5	6.9	6.5	8.9	9.4	10.2	11.0	8.2	6.6	5.2
Percent Oxygen Saturation	-	90	95	93	81	99	101	94	95	93	80	73
pH	-	7.0	5.7	6.4	6.5	6.7	6.2	7.7	6.7	6.3	7.2	-
Turbidity (NTU)[2]	-	1.2	3.9	1.1	0.6	1.2	1.4	1.2	1.0	0.4	1.2	-

[1] ESE water quality data (unpublished).

[2] P.E. LaMoreaux & Associates, Farmland Monitoring Report.

Table 8-5. PHYSICAL CHARACTERISTICS OF OAK CREEK.[1]

							1977	1978				
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
SW-2 BOTTOM: Sand, mud, thick macrophytes												
Water Temp (°C)	DRY	29.0	26.5	29.0	25.0	20.0	20.5	7.5	8.0	20.5	27.5	DRY
D.O. (mg/l)	-	2.4	2.5	2.4	0.1	6.3	4.6	9.4	5.8	6.4	3.4	-
Percent Oxygen Saturation	-	31	31	31	1	70	51	78	49	72	43	-
pH	-	6.5	5.6	6.6	6.8	5.8	6.1	6.4	6.9	5.8	5.3	-
Turbidity (NTU)[2]	-	-	1.6	0.4	0.4	0.7	5.0	0.7	1.0	0.5	-	-
SW-6; BOTTOM: Sand, mud, detritus												
Water Temp (°C)	DRY	DRY	28.0	28.0	26.0	18.0	20.0	7.5	12.0	20.5	24.0	DRY
D.O. (mg/l)	-	-	5.2	1.2	5.9	8.7	8.3	10.2	7.9	8.0	5.2	-
Percent Oxygen Saturation	-	-	67	15	73	92	91	85	73	89	62	-
pH	-	-	5.7	5.7	6.1	6.3	6.4	6.5	5.7	6.9	6.8	-
Turbidity (NTU)[2]	-	-	1.9	0.5	1.4	1.5	1.1	1.0	1.0	0.4	-	-
SW-7; BOTTOM: Sand, gravel, leaf litter												
Water Temp (°C)	25.5	25.0	28.0	28.0	25.0	17.5	20.0	8.0	12.0	20.5	22.5	24.0
D.O. (mg/l)	1.0	1.1	5.5	1.7	6.2	7.9	7.8	10.0	8.0	8.0	3.3	2.4
Percent Oxygen Saturation	12	13	71	22	76	83	86	85	74	89	38	29
pH	6.6	6.6	5.2	5.8	6.1	5.7	6.5	5.5	5.6	6.9	6.6	-
Turbidity (NTU)[2]	-	1.0	2.1	1.8	0.1	1.2	0.8	1.0	0.8	0.8	-	-
SW-8; BOTTOM: Sand, some detritus												
Water Temp (°C)	26.0	25.0	29.0	27.0	25.0	17.5	19.5	9.0	12.0	19.0	24.5	25.0
D.O. (mg/l)	3.8	4.0	5.5	4.9	6.1	7.6	7.3	10.4	8.7	7.8	7.0	6.6
Percent Oxygen Saturation	47	49	72	62	74	80	80	90	81	84	85	80
pH	6.3	6.2	5.7	4.8	6.5	6.5	6.9	6.6	6.2	6.3	7.0	7.2[2]
Turbidity (NTU)[2]	4.2	1.6	1.7	1.1	0.7	1.2	1.1	1.4	1.2	0.9	0.8	0.6

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[1] ESE water quality data (unpublished).

[2] P.E. LaMoreaux & Associates, Farmland Monitoring Report.

Table 8-6. PHYSICAL CHARACTERISTICS OF THE MARSH AND DITCH/CANAL STATIONS NOT IN A STREAM SYSTEM.[1]

							1977	1978				
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	SW-1 (Marsh): BOTTOM: Grass, sand, detritus											
Water Temp (°C)	DRY	30.0	30.0	31.0	25.0	21.0	22.0	6.5	8.0	22.5	DRY	DRY
D.O. (mg/l)	-	1.8	3.4	2.3	0.1	7.6	4.5	6.8	5.8	9.4	-	-
Percent Oxygen Saturation	-	24	45	31	1	86	52	55	49	108	-	-
pH	-	6.5	5.5	6.8	6.8	6.2	5.8	6.7	7.2	6.3	-	-
Turbidity (NTU)[2]	-	2.3	2.6	-	-	-	1.2	6.5	-	2.4	-	-
	SW-3; BOTTOM: Sand, macrophytes, detritus											
Water Temp (°C)	DRY	DRY	DRY	30.0	27.0	22.0	21.0	6.5	9.0	22.8	31.0	DRY
D.O. (mg/l)	-	-	-	0.9	0.2	3.9	4.7	8.3	6.3	9.0	7.4	DRY
Percent Oxygen Saturation	-	-	-	12	3	45	53	67	54	104	100	-
pH	-	-	-	7.0	6.7	5.1	6.1	6.2	6.8	5.8	6.0	-
Turbidity (NTU)[3]	-	-	-	-	-	-	-	0.8	0.8	-	-	-

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[1] ESE water quality data (unpublished).

[2] P.E. LaMoreaux & Associates, Farmland Monitoring Report.

[3] ESE aquatic field records.

Table 8-7. PHYTOPLANKTON COLLECTED IN MARCH 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml.[1]

Taxa	Peace River	Troublesome Creek		Hickory Creek		Oak Creek		
	SW-16	SW-11	SW-12	SW-4	SW-13	SW-2	SW-7	SW-8
PHYLUM CHLOROPHYTA								
Ankistrodesmus convolutus	.	.	.	.	.	2	.	.
Ankistrodesmus falcatus	176	.	.	1	.	3	3	5
Botryococcus sudeticus	.	.	.	.	.	.	.	.
Carteria spp.	.	.	.	.	.	3	.	.
Characium ssp.	.	.	.	.	.	.	.	.
Chlamydomonas spp.	.	4	1	.	11	3	10	6
Closterium jenner	.	.	.	.	.	.	.	.
Closterium spp.	.	.	.	.	.	.	.	.
Coccoid greens	.	11	1	1	.	5	.	.
Coelosphaerium microperum	.	.	.	.	.	.	.	.
Cosmarium angilosum	.	.	.	.	.	.	.	.
Cosmarium phaseolus	.	.	.	.	.	.	.	.
Cosmarium tinctum	.	.	.	.	.	.	2	.
Cosmarium spp.	.	.	.	.	.	.	.	1
Crucigenia tetrapedia	.	.	.	.	.	.	.	.
Desmidium aptogonum	.	.	.	.	.	.	.	.
Dictyasphaerium pulchellum	.	.	.	.	.	.	.	.
Dimorphecoccus lunatus	.	.	.	.	.	.	.	.
Elakatothrix gelatinosa	.	.	.	.	.	.	.	.
Euastrum ssp.	.	.	.	.	.	.	.	.
Gloeocystis ssp.	.	.	.	.	.	.	.	.
Kirchniriella obesa	3	.	.	.	.	.	.	.
Mougiotia ssp.	.	.	.	.	.	.	.	.
Nephrocytium limneticus	3	.	.	.	.	.	.	.
Oedigonium ssp.	.	.	.	.	.	.	.	.
Oocystis citriformis	.	.	.	.	.	.	.	.
Oocystis ssp.	.	.	.	.	.	.	.	.
Pandorina morum	.	.	.	.	.	.	.	.
Pediastrum tetras	5	.	.	.	.	.	.	.
Pleurotaenium ssp.	.	.	.	.	.	.	.	.
Scenedesmus abundans	64	.	.	.	.	.	.	.
Scenedesmus bernhardii	.	.	.	.	.	.	.	.
Scenedesmus bijuga	8	.	.	4	.	5	5	.
Scenedesmus denticulatus	.	.	.	8	.	.	.	.
Scenedesmus dimorhus	.	.	.	.	.	.	.	.
Scenedesmus longus	.	.	.	.	.	.	.	.
Scenedesmus quadricauda	24	.	.	.	.	.	.	.
Scenedesmus serratus	.	.	.	.	.	.	.	.
Scenedesmus ssp.	8	.	.	.	.	.	.	.
Selenastrum gracile	.	.	.	.	.	.	.	.
Sorastrum americanus	.	.	.	.	.	.	.	.
Sphaerocystis schroeterii	.	.	.	.	.	.	.	.
Spirogyra ssp.	.	.	.	.	.	.	.	.
Staurastrum dejectum	.	.	.	.	.	.	.	.
Staurastrum ssp.	.	.	.	4	.	3	.	.
Tetralantos ssp.	.	.	.	.	.	.	.	.
Tetraedron minimum	.	1	.	.	.	.	.	.
Tetraedron trigonum	.	.	.	.	.	.	.	.
Tetrastrum heterocantha	.	.	.	.	.	.	.	.
Ulothrix ssp.	.	.	.	.	.	.	.	.
Volvox ssp.	.	.	.	.	.	.	.	.
Zygnematales sp. Y	.	.	.	4	.	2	.	.
PHYLUM EUGLENOPHYTA								
Euglena ssp.	.	.	3	.	.	2	.	.
Lepocinclis ovum	.	.	.	.	.	.	.	.
Lepocinclis sp.A	.	.	.	.	.	.	.	.
Lepocinclis sp.C	.	.	.	.	.	.	.	.
Lepocinclis sp.D	.	.	.	1	.	.	.	.
Lepocinclis sp.E	5	.	.	.	.	2	2	.
Lepocinclis ssp.	.	.	.	.	.	.	.	1
Phacus caudata	.	.	.	.	.	.	.	.
Phacus longicaudus	.	.	.	.	.	.	.	.
Phacus orbiculare	.	.	.	.	.	.	.	.

Table 8-7. PHYTOPLANKTON COLLECTED IN MARCH 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml, Continued (Page 2 of 3).[1]

Taxa	Peace River	Troublesome Creek		Hickory Creek		Oak Creek		
	SW-16	SW-11	SW-12	SW-4	SW-13	SW-2	SW-7	SW-8
PHYLUM EUGLENOPHYTA, Continued								
Phacus pyrum	.	.	.	.	.	.	.	.
Phacus suesicus	.	.	.	.	.	.	.	.
Phacus ssp.	.	.	.	.	.	2	.	.
Trachelomonas coronata	.	.	.	.	.	.	.	.
Trachelomonas crebea	.	.	.	.	.	.	.	.
Trachelomonas cylinderica	.	.	.	.	.	.	.	.
Trachelomonas granulata	.	.	.	.	.	.	.	1
Trachelomonas incerta	.	1	.	.	2	.	3	5
Trachelomonas irregularis	.	.	.	.	.	.	.	.
Trachelomonas morum	.	.	.	.	.	.	.	.
Trachelomonas oblonga	.	.	1	.	2	.	.	1
Trachelomonas tuberculata	3	.	3	1	.	.	2	2
Trachelomonas verrucosa	.	.	.	.	.	.	.	.
Trachelomonas volvocina	8	5	1	3	5	3	12	5
Trachelomonas sp.A	.	.	.	.	.	.	.	.
Trachelomonas sp.B	.	.	.	.	.	.	.	.
Trachelomonas ssp.	.	.	.	.	.	10	3	.
PHYLUM PYRRHOPHYTA								
Chroomonas pulex	.	.	.	.	5	.	.	.
Chroomonas ssp.	8	15	.	1	.	10	54	15
Cryptochrysis ssp.	.	.	.	.	.	.	.	.
Cryptomonas ssp.	.	.	.	10	.	15	5	.
Cystodinium cornifax	.	.	.	.	.	2	.	.
Glenodinium ssp.	.	.	.	.	.	.	.	.
Gonyostomum ssp.	.	.	.	.	.	.	.	.
Nephroselmis ssp.	.	.	.	.	.	.	.	.
Peridinium inconspicuum	.	.	.	.	.	.	.	.
Peridinium ssp.	.	.	.	.	.	.	.	.
Phytoflagellate sp.A	.	.	.	.	2	.	.	.
Phytoflagellate sp.C	.	.	.	.	3	.	.	.
Phytoflagellate sp.D	.	.	.	.	.	.	.	.
Phytoflagellate sp.E	.	.	.	5	.	.	.	.
Phytoflagellate ssp.	.	.	.	25	13	11	.	.
Rhodomonas ssp.	.	1	.	.	.	.	.	.
PHYLUM CHRYSOPHYTA								
Chromulina ssp.	.	1	1	.	16	8	2	.
Chrysococcus punctiformis	106	43	16	4	139	119	146	57
Dinobryon divorgens	.	.	.	.	.	.	.	.
Dinobryon eurystoma	.	.	.	.	.	.	.	.
Lagynion ssp.	.	.	.	.	.	.	.	.
Mallomonas bernardi	.	.	.	.	.	.	2	1
Mallomonas caudata	.	.	.	3	2	.	.	.
Mallomonas majoriensis	.	.	.	.	.	.	.	.
Mallomonas radiata	.	.	.	.	.	2	.	.
Mallomonas ssp.	.	.	.	3	.	.	.	.
Ochromonas ssp.	.	.	.	.	.	.	.	.
PHYLUM CHRYSOPHYTA-SUBPHYLUM BACILLARIOPHYCEAE								
Achnanthes exigua	43	6	4	.	7	.	.	1
Achnanthes lanceolata	21	3	4	.	10	.	5	.
Achnanthes minutissima	21	.	.	.	.	.	.	.
Achnanthes ssp.	.	.	.	.	.	.	.	7
Amphora ssp.	3	1	.	.	.	.	.	.
Cocceneis placentula	3	.	.	.	.	.	.	.
Cocceneis scutellum	3	3	3	.	11	.	7	.
Cocceneis ssp.	.	.	.	.	.	.	.	1
Cyclotella glomerata	.	.	.	6	.	.	.	.
Cyclotella meneghiniana	.	.	1	1	.	5	2	.
Cyclotella stelligera	.	.	.	.	2	.	.	.
Cyclotella ssp.	.	.	.	.	.	.	.	.
Cymbella ssp.	11	.	.	1	2	2	.	.

Table 8-7. PHYTOPLANKTON COLLECTED IN MARCH 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml, Concluded (Page 3 of 3).[1]

Taxa	Peace River	Troublesome Creek		Hickory Creek		Oak Creek		
	SW-16	SW-11	SW-12	SW-4	SW-13	SW-2	SW-7	SW-8
PHYLUM CHRYSOPHYTA-SUBPHYLUM BACILLARIOPHYCEAE, Continued								
Eunotia ssp.	3	.	.	1	.	3	2	1
Fragilaria construens	61	.	.	.	.	.	.	.
Frustulia ssp.	.	.	.	.	.	.	.	.
Gomphonema ssp.	5	3	2	.	2	.	.	1
Hantzschia ssp.	.	.	.	.	.	.	2	.
Melosira islandica	.	.	.	.	.	.	.	.
Melosira varians	11	.	.	.	.	.	.	.
Melosira ssp.	.	.	.	.	.	.	.	.
Navicula confervacea	27	.	.	.	.	5	.	.
Navicula hungarica	13	30	14	.	10	.	.	.
Navicula indifferens	.	.	.	3	.	5	10	1
Navicula sp.A	.	.	.	.	.	.	.	.
Navicula ssp.	61	13	24	9	13	13	20	11
Nitzschia acicularis	.	.	.	.	.	2	.	.
Nitzschia filiformis	.	.	.	.	.	.	.	.
Nitzschia fonticola	45	.	.	.	.	.	.	.
Nitzschia palea	29	4	5	21	7	15	.	12
Nitzschia ssp.	5	1	2	6	5	2	2	6
Pleurosigma ssp.	3	.	1	.	.	.	.	.
Rhopolodia gibba	.	.	.	.	.	.	.	.
Rhopolodia ssp.	.	.	1	1	2	.	.	.
Stauroneis ssp.	3	.	1	.	.	.	.	.
Surirella angustata	3	.	.	.	.	.	.	.
Synedra ulna	.	.	.	.	.	.	.	.
Synedra ssp.	5	.	1	.	.	.	.	.
PHYLUM CYANOPHYTA								
Anabaena subcylindrica	.	.	.	.	.	.	.	.
Anabaena ssp.	.	1	1	.	.	2	.	.
Aphanocapsa delicatissima	.	.	.	.	.	.	.	.
Aphanocapsa pulchra	.	.	.	.	.	.	.	.
Aphanothece ssp.	.	.	.	.	.	.	.	1
Calothrix ssp.	.	.	.	.	.	.	.	.
Chroococcus ssp.	11	.	.	.	.	.	3	.
Coelosphaerium ssp.	.	.	.	.	.	.	.	.
Eucapsis alpina	.	.	.	.	.	.	.	.
Lyngbya contorta	40	.	.	.	.	.	.	.
Lyngbya nana	.	.	.	.	.	.	.	.
Lyngbya ssp.	.	.	.	.	.	.	.	.
Merismopedia tennvissima	.	.	.	.	.	.	.	.
Nodularia ssp.	.	.	.	1	.	.	.	.
Oscillatoria geminata	.	.	.	.	.	.	.	.
Oscillatoria splendens	.	.	.	.	.	.	.	.
Oscillatoria ssp.	.	.	5	1	.	.	.	1
Pleurocapsa ssp.	.	.	.	.	.	.	.	.
Synechococcus ssp.	.	.	.	.	.	.	.	.

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[1] Source: ESE unpublished aquatic data.

Table 8-8. PHYTOPLANKTON COLLECTED IN MAY 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml.[1]

	Peace River	Troublesome Creek		Hickory Creek	Oak Creek		
	SW-16	SW-11	SW-12	SW-13	SW-2	SW-7	SW-8
PHYLUM CHLOROPHYTA							
Ankistrodesmus convolutus	.	.	.	1	.	.	.
Ankistrodesmus falcatus	.	.	5	3	130	.	1
Chlamydomonas ssp.	283	.	1	8	1,238	.	1
Closteriopsis ssp.	31	2	3	.	.	5	1
Closterium spp.	.	.	.	3	.	.	.
Coccoid greens	283	.	.	3	195	5	.
Cosmarium phaseolus	.	.	.	.	.	.	.
Cosmarium spp.	31	.	.	.	.	.	.
Crucigenia cricofera	.	.	.	.	130	.	.
Elakatothrix gelatinosa	31	.	.	1	.	.	.
Eudorina elegans	.	.	.	.	.	.	.
Microtinium pusillium	31	.	.	.	.	.	.
Nephrocytium limneticus	31	.	.	.	.	.	.
Oocystis parva	.	.	.	.	65	.	.
Oocystis ssp.	31	.	.	.	.	.	.
Pediastrum duplex	502	.	.	.	.	.	.
Scenedesmus abundans	502	.	.	.	.	.	.
Scenedesmus bernhardii	31	.	.	.	.	.	.
Scenedesmus bijuga	.	.	.	.	.	.	.
Scenedesmus denticulatus	.	.	.	.	65	.	.
Scenedesmus dimorhus	.	.	.	.	65	.	.
Scenedesmus quadricauda	848	.	.	.	.	.	.
Scenedesmus serratus	.	.	.	.	.	.	.
Scenedesmus ssp.	.	.	.	.	.	5	.
Staurastrum dilatatum	.	.	.	.	.	.	.
Stichococcus scopulinus	.	.	.	.	.	.	.
Tetraedron minimum	.	.	.	.	.	.	.
Tetraedron pentaedricum	.	.	.	.	.	.	.
Zygnematales sp. Y	.	.	.	.	.	.	.
PHYLUM EUGLENOPHYTA							
Euglena ssp.	31	.	.	.	1,368	.	3
Lepocinclis ovum	.	.	.	.	3,648	37	.
Phacus agilis	.	.	.	.	521	.	.
Phacus granum	.	.	.	5	651	.	.
Phacus indicus	.	.	.	.	.	.	.
Phacus lepocincloides	.	.	.	.	521	.	.
Phacus orbiculare	.	.	.	.	65	5	1
Phacus pyrum	.	.	.	.	326	.	.
Phacus raciberskii	.	.	.	.	.	.	.
Phacus redicula	.	.	.	.	195	.	.
Phacus suesicus	.	.	.	.	.	.	1
Trachelomonas acanthostoma	.	.	.	1	.	.	1
Trachelomonas allegori	.	.	.	.	.	.	.
Trachelomonas armatus	.	.	.	.	65	.	.
Trachelomonas coronata	.	.	.	.	65	5	.
Trachelomonas globularis	.	.	1	.	.	.	.
Trachelomonas hispida	.	.	.	.	65	.	.
Trachelomonas incerta	.	.	.	.	.	.	3
Trachelomonas oblonga	.	.	1	.	1,107	.	.
Trachelomonas pulcherima	.	.	.	1	.	.	.
Trachelomonas rolli	.	.	.	.	261	.	.
Trachelomonas tuberculata	.	.	1	.	.	.	.
Trachelomonas volvocina	31	.	.	.	5,407	85	.
Trachelomonas ssp.	.	.	.	.	.	.	.
PHYLUM PYRRHOPHYTA							
Chroomonas ssp.	.	8	4	13	977	128	8
Cryptomonas ssp.	.	.	5	5	3,062	90	4
Glenodinium ssp.	.	.	.	.	326	.	.
Gymnodinium ordinatum	.	.	.	.	195	5	.

Table 8-8. PHYTOPLANKTON COLLECTED IN MAY 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml, Continued (Page 2 of 3).[1]

	Peace River	Troublesome Creek		Hickory Creek	Oak Creek		
	SW-16	SW-11	SW-12	SW-13	SW-2	SW-7	SW-8
PHYLUM PYRRHOPHYTA, Continued							
Peridinium inconspicuum	.	.	.	.	.	.	.
Phytoflagellate sp.C	.	.	.	1	1,368	11	.
Phytoflagellate sp.E	.	.	.	.	.	.	.
Phytoflagellate sp.F	.	.	.	.	.	.	.
Phytoflagellate ssp.	.	4	8	23	651	122	16
PHYLUM CHRYSOPHYTA							
Chrysamoeba ssp.	.	16	5	.	.	.	.
Chromulina ssp.	.	.	4	.	.	27	.
Chrysococcus punctiformis	31	3	7	36	30,746	202	9
Dinobryon divorgens	.	.	.	.	.	.	.
Kephyrion ovum	.	.	.	.	.	.	.
Lagynion ssp.	.	.	.	.	.	5	.
Mallomonas bernardi	.	.	.	.	65	.	.
Mallomonas caudata	.	.	.	.	.	11	.
Mallomonas majoriensis	.	.	.	.	.	.	.
Mallomonas ssp.	.	1	.	.	.	.	.
Ochromonas ssp.	.	.	.	.	130	.	.
Synechococcus ssp.	.	.	.	.	.	.	.
Uroglena americana	.	.	.	.	.	.	.
PHYLUM CHRYSOPHYTA - SUBPHYLUM XANTHOPHYCEAE							
Ophiocytium capitatum	.	.	.	.	.	.	.
Tribonema affine	.	.	.	.	.	.	.
PHYLUM CHRYSOPHYTA-SUBPHYLUM BACILLARIOPHYCEAE							
Achnanthes exigua	.	6	6	12	.	.	29
Achnanthes lanceolata	.	.	.	2	.	.	20
Achnanthes minutissima	.	3	.	.	.	.	.
Achnanthes ssp.	126	.	.	.	.	.	13
Amphora ssp.	.	.	.	.	.	.	.
Cocceneis scutellum	.	4	.	10	.	5	5
Cocceneis ssp.	.	.	1	.	.	.	.
Cyclotella meneghiniana	.	.	.	7	.	.	.
Cyclotella ssp.	.	5	.	.	65	.	5
Cymbella ssp.	.	.	.	1	.	.	1
Eunotia ssp.	.	.	.	.	.	.	.
Fragilaria construens	7,282	.	.	.	.	.	7
Gomphonema ssp.	.	2	.	8	.	.	.
Gyrosygma ssp.	.	.	.	.	.	.	.
Navicula confervacea	.	3	.	.	1,498	.	4
Navicula hungarica	.	12	1	3	.	.	26
Navicula indifferens	.	6	5	3	.	.	.
Navicula ssp.	126	17	7	14	130	59	45
Nitzschia acicularis	.	.	.	.	65	.	.
Nitzschia palea	.	4	.	33	782	16	10
Nitzschia trybhonella	.	1	1	.	.	.	1
Nitzschia ssp.	157	2	3	4	65	16	5
Pinnularia ssp.	.	.	.	1	.	.	.
Rhopolodia gibba	.	.	.	.	.	.	.
Stauroneis ssp.	.	.	.	.	.	.	4
Surirella angustata	.	.	.	3	.	.	.
Synedra ulna	.	.	.	2	.	.	1
PHYLUM CYANOPHYTA							
Anabaena ssp.	.	.	.	.	65	.	.
Aphanocapsa delicatissima	816	.	.	.	130	11	.
Aphanocapsa pulchra	.	.	.	.	.	.	.
Aphanothece ssp.	31	.	.	.	.	.	.

Table 8-8. PHYTOPLANKTON COLLECTED IN MAY 1979 ON THE FARMLAND MINE SITE EXPRESSED AS CELLS/ml, Concluded (Page 3 of 3).[1]

	Peace River	Troublesome Creek		Hickory Creek	Oak Creek		
	SW-16	SW-11	SW-12	SW-13	SW-2	SW-7	SW-8
PHYLUM CYANOPHYTA, Continued							
Chroococcus dispersis	.	.	.	.	.	.	.
Chroococcus limneticus	848	.	.	.	65	.	.
Chroococcus minutus	.	.	1	.	.	.	.
Chroococcus ssp.	.	.	.	1	.	5	.
Gomphosphaeria aponina	63	.	.	1	.	.	.
Lyngbya contorta	6,655	.	.	.	.	.	.
Lyngbya nana	283	.	.	3	.	43	.
Lyngbya ssp.	.	.	.	.	.	.	.
Merismopedia tennvissima	1,915	.	.	.	65	11	.
Nodularia ssp.	.	.	.	.	.	.	.
Oscillatoria articulata	.	3	.	.	.	.	.
Oscillatoria geminata	63	.	.	3	65	.	3
Oscillatoria ssp.	.	.	.	2	65	5	.
Pleurocapsa ssp.	.	.	1	.	.	.	.

[1] Source: ESE unpublished aquatic data.

Table 8-9. NUMBER OF PHYTOPLANKTON TAXA COLLECTED IN EACH SYSTEM DURING 1978-1979, (Numbers in Parentheses Indicate the Number of Stations Sampled).[1]

Collection Date	Peace River	Troublesome Creek	Hickory Creek	Oak Creek
March 1979	36 (1)	28 (2)	39 (2)	48 (3)
May 1979	27 (1)	29 (2)	33 (2)	63 (3)

[1] Source: ESE unpublished aquatic data.

Table 8-10. RELATIVE DENSITIES[1] AND PRESENCE OF BENTHIC ORGANISMS COLLECTED JUNE 1977 THROUGH MAY 1978 USING A PONAR SAMPLER AND QUALITATIVE GRAB SAMPLES, RESPECTIVELY[2].

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Ditch/ Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Nematoda	R	P					R	R	P				P	R
Annelida														
Oligochaeta	C	C	A	A	A	A	C	C	A	A	A	A	A	A
Hirudinea														
Helobdella sp.			R							O				
Helobdella stagnalis	R	P	R			R			P	O	O	R		O
Placobdella sp.			R			P			P	R		R	P	P
Amphipoda														
Hyalella azteca	R	O	R	P	P	R			R	R	O	P	P	R
Isopoda														
Asellus sp.			O	O					P		O	R		
Decapoda														
Palaemonetes paludosus	P	P	P	O				P			R	R		
Procambarus sp.			P			P	R		P	O	P	P	O	O
Ephemeroptera														
Baetis sp.	O	R	R			P	P	P		P	R	R		P
Baetis intercalaris			P											
Baetis spinosus							R				R			
Brachycercus sp.	P													
Caenis diminuta	C	A	P	O	O	O		R		P	P	R		P
Callibaetus sp.														P
Callibaetis floridanus	P					P		R				P	P	
Centroptilum viridocularis			P											
Stenonema sp.			R	O	R	R						R		
Stenonema exiguum	O	P								P		P		
Stenonema proximum	P	P	R	P		R		P				P		
Stenonema smithae	P	P	R	P		R		P		P		P		
Tricorythodes albilineatus	P	P				P		P						
Odonata														
Aeschna sp.			R					P			P	R		P
Agrionidae	P													
Agrion sp.	R	R				P								
Amphiagrion sp.					P									
Argia sp.	R	R	P	P		R	R	P			P	P		
Boyeria sp.											P			
Calopteryx sp.	R		P				R	P		P	P	R		
Dromogomphus sp.			R											
Enallagma sp.	P	P	P		P	R		P	P	P	P	R	P	P
Erythemis sp.		P	R			P						R		P
Gomphus sp.		R	O									R		
Libellula pulchella						P					P			
Macromia sp.	P	P	O	O	P					P	R			P
Nannothemis bella														P
Nehallenia sp.				R										
Neone sp.					R									
Pachydiplax longipennis						P		P						P
Plathemis thydia									P					
Progomphus sp.		P												
Progomphus obscura			P											
Trichoptera														
Arctopsyche sp.	P	P												
Athripsodes sp.		P	R	P				R						
Cheumatopsyche sp.	C	R	O	P	R	C	C	R	P	O	O	R		P
Cyrnellus sp.	P			P										
Hydropsyche sp.								P						
Hydropsyche frisoni	A	R										P		
Hydropsyche simulans	P	P	P					P		P	P			
Hydroptila sp.		P						P						
Leptocella sp.		R						O						
Myatrichia sp.		R												
Neureclipsis sp.	R			R										
Oecetis sp.			R			R						P		
Oxyethira sp.	R	P		P	P									
Polycentropus sp.	R			O										
Triaenodes sp.						R								

Table 8-10. RELATIVE DENSITIES[1] AND PRESENCE OF BENTHIC ORGANISMS COLLECTED JUNE 1977 THROUGH MAY 1978 USING A PONAR SAMPLER AND QUALITATIVE GRAB SAMPLES, RESPECTIVELY[2], Continued (Page 2 of 4).

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Ditch/Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Hemiptera														
Belostoma sp.	P			P	P	P			P		P	P	P	P
Corixidae													P	
Gerris sp.													P	
Hydrometra sp.										P				
Microvelia sp.														P
Pelocoris sp.					P								P	
Rhagovelia sp.	P			P										
Trichocorixa sp.							P						P	
Velliidae												P		
Coleoptera														
Berosus sp.					P									
Dineutus sp.					P	P				R		P	P	
Dineutus carolinus	R	R	O	P								O		
Dubiraphia sp.	R		R		P	R	R	P			R	R		P
Dytiscidae	R		R		P	R	R	P		P	R	R	P	
Gyrinus sp.						R		P	P					
Haliplidae														R
Hydaticus sp.								P						
Hydrocanthus sp.	P	P	P	R	P	P		P			P	P	P	P
Hydrocanthus oblongus												P		
Hydrophilidae									P					
Hydroporus sp.			P						P			P		P
Microcyelloepus sp.	R	P	C				R	P		P	R	P		
Peltodytes sp.													P	P
Scirtes sp.	P	P	P		P				P		P			P
Stenelmis sp.	R	P	R	O		R	P	P		R	R	O		
Tropisternus sp.	R													
Lepidoptera														
Nymphula sp.	R	R												
Megaloptera														
Chauloides sp.		P												
Corydalus cornutus	P	P		P				P						
Sialis sp.	P		P	R										
Diptera														
Ablabesmyia sp.				O						O	R			
Ablabesmyia aspera	R	R	O	R		P	R	O		R	P	O		
Ablabesmyia janta								R						
Ablabesmyia ornata										O	R			
Ablabesmyia peleensis	R		P	O	R	R		R	P	R	R		P	R
Ablabesmyia philosphangris						P								
Aphrosylus sp.						R								
Bezzia sp.	O	C	C	O	C	R	O	O	O	O	R	O	O	O
Brachydeutera sp.											P			
Brillia sp.		P												
Cardiocladius sp.						P								
Chaoborus punctpennis											R			R
Chironomus sp.						R					R	R	P	
Chironomus attenuatus			R		O		C		C	R	C	C	C	C
Chironomus carus		P				R					P		P	O
Chironomus crassicaudatus	P													
Chironomus stigmaterus							C		C		P	O		
Cladotanytarsus sp.											P			
Clinotanypus sp.											R			
Clinotanypus pinguis	R			R				P	R	O	R			P
Conchopelopia sp.	O	O	P	O	O	O	P	P	R	R	O	R	P	P
Corynoneura sp.	P	O		P	P	P	P	P			P			
Cricotopus sp.							R	P				P		
Cricotopus bicinctus	P	P			R	R	O	P						
Cryptochironomus sp.					R									
Cryptochironomus fulvus	R	O	O		C	O	O	O		O	O	R		
Dicrotendipes sp.	R	R		P				R		P			R	O
Dicrotendipes nervosus		C					O					R		
Empididae	P	P	R	P	R	R		P						
Endochironomus sp.	P									P			P	R

Table 8-10. RELATIVE DENSITIES[1] AND PRESENCE OF BENTHIC ORGANISMS COLLECTED JUNE 1977 THROUGH MAY 1978 USING A PONAR SAMPLER AND QUALITATIVE GRAB SAMPLES, RESPECTIVELY[2], Continued (Page 3 of 4).

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Ditch/ Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Diptera, Continued														
Eukiefferiella sp.													P	
Glyptotendipes sp.											P		R	
Harnischia sp.						R	R							
Helius sp.												R		
Hexatoma sp.								R				O	P	
Hydrophorus sp.						R			P					
Kiefferulus sp.													P	
Labrundinia sp.	P			P	R	P	P	R			P	P		
Micropsectra sp.	P	R	P	O	P	R		O		O	R	P		
Nanocladius sp.							P				P			
Nilothaulma sp.						R								
Nilothaulma bicornis	P					R								
Odontomyia sp.	P					P								
Orthocladius sp.	R		P	R	P		P	R				R		
Palpomyia sp.			R					O						
Palpomyia tibialis						R		P	P	R			P	O
Parachironomus sp.											R		R	
Paracladopelma sp.			R	O		R						R	R	R
Paralauterborniella sp.					C					R	R			
Paratendipes sp.	P													
Pedionomus sp.								R						
Pedionomus beckae										R			P	
Pentaneura sp.						P		P		P				
Phaenopsectra sp.								P						
Polypedilum fallax										P			P	
Polypedilum halterale	O	C	O	O	C	R	C	O	R	O	O	R	R	R
Polypedilum illinoense	P	P	O	P	O	R	O	R	R	O	R	R	R	O
Polypedilum tritum	R	O	O		R	P	R				R	R		
Procladius sp.	O		O	C			R			R	R	R	R	R
Psectrocladius sp.				P	R	R	R			R				P
Pseudochironomus sp.		R												P
Psychodidae			O											
Rhagionidae			R											
Rheotanytarsus sp.	P	P				R	R	P		P	O	R		
Rheotanytarsus exiguus		P	R	P	O	C	P	O		O	O	O		
Simulium sp.	R	P	R	P		P	O	R		P	O	R		
Stenochironomus sp.			R											
Stenochironomus hilaris	P	P	R	O			P	P		R	R	P		
Tabanus sp.						P								
Tanypus sp.														
Tanytarsus sp.	O	O	O	C	O	R	C	C	P	O	O	R	P	P
Thienemanniella sp.		O		P	O	O	O	R		R	R			P
Tipula sp.						P								
Tipulidae	R													
Tribelos sp.	P													
Mollusca						P								
Amnicola sp.				O		P						P		
Campeloma sp.											O	O		
Clappia sp.				P							P	P		
Clappia clappia				P							R	P		
Corbicula sp.											P			
Corbicula manilensis	C	O	C				A	O		R				
Elliptio sp.				O								R		
Eupera cubensis	R	R	P	R			R	C		R	R	R		
Ferrissia sp.		P	P	R	P	R	P	O	R	C	R	P	P	P
Gundlachia sp.												P		
Gyraulas sp.	P	P				P			P	P		P	P	R
Helisoma sp.	O			P		P		P		R	R	R	P	P
Helisoma duryi	O	R									R	R		
Laevapex sp.								P			O	R		
Lampsilis sp.			R											
Lyogyrus sp.			R								P		P	
Marisa sp.									P				P	P

Table 8-10. RELATIVE DENSITIES[1] AND PRESENCE OF BENTHIC ORGANISMS COLLECTED JUNE 1977 THROUGH MAY 1978 USING A PONAR SAMPLER AND QUALITATIVE GRAB SAMPLES, RESPECTIVELY[2], Concluded (Page 4 of 4).

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Ditch/ Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Mollusca, Continued														
Physa sp.	P		R	C		P	R	O	P	O	P	R	P	P
Pisidium sp.	P	P									O			
Pomacea sp.	P							P				P		
Pseudosuccinea sp.	P	P		P							P		P	P
Pseudosuccinea columella													P	
Sphaerium sp.		R	O	C			R	O	R	C	C	C		
Sphaerium transversum														
Viviparus sp.			P							R	R	O		
Collembola												R		
TOTAL TAXA	76	66	68	55	36	70	43	63	31	55	70	76	45	51

[1] A = Abundant (>25% individuals), C = Common (5-25%), O = Occasional (1-5%), R = Rare (<1%).

[2] Source: Farmland DRI.

Table 8-11. NUMBER OF BENTHIC TAXA COLLECTED USING A PONAR SAMPLER FROM JUNE 1977 THROUGH MAY 1978.[1]

	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Ditch/ Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
1977														
June	24	19	25	0	DRY	DRY	7	DRY	DRY	DRY	15	15	DRY	DRY
July	6	5	7	7	10	9	7	10	4	DRY	3	2	2	DRY
August	1	1	2	1	1	1	2	2	2	3	8	2	3	DRY
September	3	2	5	3	9	5	1	1	1	3	6	7	2	3
October	N.S.[2]	N.S.	5	4	0	10	9	2	3	7	17	6	3	4
November	5	5	9	2	5	2	8	9	3	12	15	8	3	2
December	3	4	19	10	3	6	10	7	1	13	17	7	2	3
1978														
January	3	3	16	2	5	12	12	16	2	6	7	9	2	3
February	1	1	7	10	8	10	10	3	3	1	4	8	1	3
March	2	5	6	9	11	9	4	2	3	0	12	7	7	8
April	6	11	10	4	DRY	DRY	8	8	5	12	6	20	DRY	10
May	8	3	7	3	DRY	DRY	10	11	DRY	DRY	9	5	DRY	DRY
MEAN NUMBER OF TAXA	5.6	5.4	9.8	4.6	5.8	7.1	7.3	6.5	2.7	6.3	9.9	8.0	2.8	4.5
TOTAL TAXA	40	30	47	31	22	39	32	31	11	37	47	50	11	20

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[1] ESE unpublished aquatic data.

[2] N.S. = not sampled.

Table 8-12. SCIENTIFIC AND COMMON NAMES OF FISHES RECENTLY COLLECTED ON OR ADJACENT TO FARMLAND PROPERTY.[1]

Scientific Name	Common Name
Amiidae - bowfins	
Amia calva	Bowfin
Lepisosteidae - gars	
Lepisosteus osseus	Longnose gar
Lepisosteus platyrhincus	Florida gar
Anguillidae - freshwater eels	
Anguilla rostrata	American eel
Clupeidae - herrings	
Dorosoma cepedianum	Gizzard Shad
Cyprinidae - minnows and carps	
Hybopsis harperi	Redeye chub
Notemigonus crysoleucas	Golden shiner
Notropis maculatus	Taillight shiner
Notropis petersoni	Coastal shiner
Notropis texanus	Weed shiner
Notropis sp.	
Catostomidae - suckers	
Erimyzon sucetta	Lake chubsucker
Ictaluridae - freshwater catfishes	
Ictalurus catus	White catfish
Ictalurus natalis	Yellow bullhead
Ictalurus nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Noturus sp.	Madtom
Claridae - airbreathing catfishes	
Clarius batrachus	Walking catfish
Aphredoderidae - pirate perches	
Aphredoderus sayanus	Pirate Perch
Belonidae - needlefishes	
Strongylura sp.	Needlefish

Table 8-12. SCIENTIFIC AND COMMON NAMES OF FISHES RECENTLY COLLECTED ON OR ADJACENT TO FARMLAND PROPERTY[1], Continued (Page 2 of 2)

Scientific Name	Common Name
Cyprinodontidae - killifishes	
Adinia xenica	Diamond killifish
Fundulus chrysotus	Golden topminnow
Fundulus seminolis	Seminole killifish
Fundulus sp.	
Jordanella floridae	Flagfish
Lucania goodei	Bluefin killifish
Poeciliidae - livebearers	
Gambusia affinis	Mosquitofish
Heterandria formosa	Least killifish
Poecilia latipinna	Sailfin molly
Atherinidae - silversides	
Labidesthes sicculus	Brook silverside
Centropomidae - snooks	
Centropomus undecimalis	Snook
Centrarchidae - sunfishes	
Elassoma evergladei	Everglades pygmy sunfish
Elassoma zonatum	Banded pygmy sunfish
Lepomis gulosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis marginatus	Dollar sunfish
Lepomis microlophus	Redear sunfish
Lepomis punctatus	Spotted sunfish
Micropterus salmoides	Largemouth bass
Promoxis nigromaculatus	Black crappie
Percidae - perches	
Etheostoma fusiforme	Swamp darter
Cichlidae - cichlids	
Tilapia aurea	Blue tilapia
Mugilidae - mullets	
Mugil sp.	Mullet
Soleidae - soles	
Achirus lineatus	Lined sole
Trinectes maculatus	Hogchoker

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[1] Sources: Ware 1969, Chapman 1973, ESE aquatic field records.

Table 8-13. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON JUNE 14 and 15, 1977.[1]

	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
Taxa	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae				N.S.[2]	DRY	DRY		DRY	DRY				DRY	DRY
Hybopsis harperi														
Notropis petersoni														
Notropis texanus							P							
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.	P													
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica			P				P							
Fundulus sp.	P	P												
Jordanella floridae														
Poeciliidae														
Gambusia affinis		P	P				P				P	P		
Heterandria formosa			P				P				P			
Poecilia latipinna														
Atherinidae														
Labidesthes sicculus	P	P												
Centrarchidae														
Elassoma evergladei														
Elassoma zonatum														
Lepomis gulosus												P		
Lepomis macrochirus		P												
Lepomis punctatus														
Micropterus salmoides	P	P												
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	4	5	3	-	-	-	4	-	-	0	2	2	-	-

---

[1] Source: ESE aquatic field records.

[2] N.S. = Not sampled.

Table 8-14. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON JULY 18 THROUGH 21, 1977.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae	N.S.[2]	N.S.	N.S.	N.S.	N.S.		N.S.		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Hybopsis harperi								P						
Notropis petersoni														
Notropis texanus														
Notropis sp.								P						
Ictaluridae														
Ictalurus catus						P								
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.								P						
Jordanella floridae														
Poeciliidae														
Gambusia affinis								P						
Heterandria formosa														
Poecilia latipinna								P						
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei														
Elassoma zonatum														
Lepomis gulosus														
Lepomis macrochirus								P						
Lepomis punctatus														
Micropterus salmoides								P						
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	-	-	-	-	-	1	-	7	-	-	-	-	-	-

[1] *Source*: ESE aquatic field records.

[2] N.S. = Not sampled.

Table 8-15. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON SEPTEMBER 10 AND 11, 1977.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.			P											
Ictaluridae														
Ictalurus catus										P				
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.	P	P	P				P							
Jordanella floridae														P
Poeciliidae														
Gambusia affinis	P	P	P		P		P	P		P	P			P
Heterandria formosa		P			P					P				P
Poecilia latipinna	P	P												
Atherinidae														
Labidesthes sicculus	P	P	P		P					P				
Centrarchidae														
Elassoma evergladei														P
Elassoma zonatum											P			
Lepomis gulosus														
Lepomis macrochirus			P		P					P	P			
Lepomis punctatus														
Micropterus salmoides					P		P							
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus		P												
TOTAL TAXA	4	6	5	0	5	0	3	1	0	5	3	0	0	4

---

[1] Source: ESE aquatic field records.

Table 8-16. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON OCTOBER 11 THROUGH 13, 1977.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae														
Poeciliidae														
Gambusia affinis	P		P	P	P		P	P			P		P	P
Heterandria formosa			P										P	P
Poecilia latipinna														P
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei														
Elassoma zonatum														
Lepomis gulosus														
Lepomis macrochirus														
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	1	0	2	1	1	0	1	1	0	0	1	0	2	3

---

[1] *Source*: ESE aquatic field records.

Table 8-17. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON NOVEMBER 16 THROUGH 18, 1977.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.	P						P							
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.	P	P					P							
Jordanella floridae														
Poeciliidae														
Gambusia affinis	P	P	P	P	P	P	P		P		P	P	P	P
Heterandria formosa	P	P	P		P	P			P		P		P	P
Poecilia latipinna			P											P
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei				P	P									
Elassoma zonatum					P									P
Lepomis gulosus														
Lepomis macrochirus														
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	4	3	3	2	4	2	3	0	2	0	2	1	2	4

[1] Source: ESE aquatic field records.

Table 8-18. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON DECEMBER 12 THROUGH 15, 1977.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae														
Poeciliidae														
Gambusia affinis	P	P	P	P	P	P	P	P	P		P	P		P
Heterandria formosa		P			P	P		P	P		P		P	P
Poecilia latipinna		P									P			
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei														
Elassoma zonatum														
Lepomis gulosus														
Lepomis macrochirus														
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	1	3	1	1	2	2	1	2	2	0	3	1	1	2

---

[1] Source: ESE aquatic field records.

Table 8-19. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON JANUARY 10 AND 11, 1978.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae														
Poeciliidae														
Gambusia affinis	P	P		P	P		P		P				P	P
Heterandria formosa	P	P			P				P				P	P
Poecilia latipinna														
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei							P						P	
Elassoma zonatum														
Lepomis gulosus														
Lepomis macrochirus														
Lepomis punctatus													P	
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	2	2	0	1	2	0	2	0	2	0	0	0	4	2

[1] Source: ESE aquatic field records.

Table 8-20. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON FEBRUARY 21 AND 22, 1978.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae														P
Poeciliidae														
Gambusia affinis	P	P	P	P		P			P		P	P	P	P
Heterandria formosa	P		P			P			P		P	P	P	P
Poecilia latipinna														
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei														P
Elassoma zonatum														
Lepomis gulosus									P					
Lepomis macrochirus														
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	2	1	2	1	0	2	0	0	3	0	2	2	2	4

[1] *Source*: ESE aquatic field records.

Table 8-21. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON MARCH 12 THROUGH 14, 1978.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae														
Hybopsis harperi														
Notropis petersoni		P												
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis														
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus														
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae					P									P
Poeciliidae														
Gambusia affinis	P	P	P		P	P	P	P	P	P	P	P	P	P
Heterandria formosa			P		P				P	P	P	P	P	P
Poecilia latipinna														
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei				P		P				P				P
Elassoma zonatum														
Lepomis gulosus						P								
Lepomis macrochirus														
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme									P					
Soleidae														
Trinectes maculatus														
TOTAL TAXA	1	2	2	1	3	3	1	1	3	2	3	2	2	4

---

[1] Source: ESE aquatic field records.

Table 8-22. FISHES COLLECTED BY SEINE AND/OR DIPNET ON OR NEAR THE FARMLAND PROPERTY ON MAY 16 THROUGH 18, 1978.[1]

Taxa	Peace River		Troublesome Creek		Hickory Creek				Oak Creek				Marsh	Canal
	SW-15	SW-16	SW-11	SW-12	SW-4	SW-9	SW-13	SW-14	SW-2	SW-6	SW-7	SW-8	SW-1	SW-3
Cyprinidae					DRY	DRY			DRY	DRY			DRY	DRY
Hybopsis harperi														
Notropis petersoni														
Notropis texanus														
Notropis sp.														
Ictaluridae														
Ictalurus catus														
Ictalurus natalis											P			
Noturus sp.														
Aphredoderidae														
Aphredoderus sayanus											P			
Cyprinodontidae														
Adinia xenica														
Fundulus sp.														
Jordanella floridae														
Poeciliidae														
Gambusia affinis	P	P		P				P				P		
Heterandria formosa	P	P		P				P			P			
Poecilia latipinna														
Atherinidae														
Labidesthes sicculus														
Centrarchidae														
Elassoma evergladei		P									P			
Elassoma zonatum														
Lepomis gulosus														
Lepomis macrochirus		P												
Lepomis punctatus														
Micropterus salmoides														
Percidae														
Etheostoma fusiforme														
Soleidae														
Trinectes maculatus														
TOTAL TAXA	2	4	0	2	-	-	0	2	-	-	4	1	-	-

---

[1] *Source*: ESE aquatic field records.

Table 8-23. FISHES PRESENT ON OR NEAR FARMLAND PROPERTY DURING 1977- 1978.[1]

Taxa	Peace River	Troublesome Creek	Hickory Creek	Oak Creek
Cyprinidae				
Hybopsis harperi			X	
Notropis petersoni	X			
Notropis texanus			X	
Notropis sp.	X	X	X	
Ictaluridae				
Ictalurus catus			X	X
Ictalurus natalis				X
Noturus sp.	X			
Aphredoderidae				
Aphredoderus sayanus				X
Cyprinodontidae				
Adinia xenica		X	X	
Fundulus sp.	X	X	X	
Jordanella floridae			X	
Poeciliidae				
Gambusia affinis	X	X	X	X
Heterandria formosa	X	X	X	X
Poecilia latipinna	X	X	X	X
Atherinidae				
Labidesthes sicculus	X	X	X	X
Centrarchidae				
Elassoma evergladei	X	X	X	X
Elassoma zonatum			X	X
Lepomis gulosus				X
Lepomis macrochirus	X	X	X	X
Lepomis punctatus				X
Micropterus salmoides	X		X	
Percidae				
Etheostoma fusiforme				X
Soleidae				
Trinectes maculatus	X			
TOTAL TAXA	12	9	15	12

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[1] Farmland Industries, Inc. DRI June 1979.

9.0
TERRESTRIAL ECOLOGY

9.1 THE AFFECTED ENVIRONMENT

9.1.1 REGIONAL DESCRIPTION

The site is located in peninsular Florida on the Coastal Lowlands west of the Peace River in southwest Hardee County. Peninsular Florida is a biological transition zone supporting both temperate and subtropical species. Many temperate-zone species are reported to reach their southern limits in the vicinity of the Peace River (Harper 1927).

Vegetative Cover of the Phosphate Region

A general description of the land use and cover types occurring in the site region is presented in the Central Florida Phosphate Industry Areawide Impact Assessment Program published by the U.S. Environmental Protection Agency in September 1978 (Texas Instruments 1978). The study encompassed about 3,023,916 acres in seven counties of western peninsular Florida including Hardee County. The vegetative cover of the region was classified as follows:

- Agricultural land (1,128,563 acres)
  - cropland and pasture
  - orchards, groves, and nurseries
  - other agricultural lands

- Rangeland (1,116,238 acres)
  - herbaceous rangeland
  - shrub and brush rangeland
  - mixed rangeland
- Forest Land (172,101 acres)
  - deciduous forestland
  - evergreen forestland
  - mixed forestland
- Wetland (440,444 acres)

  Wooded
  - swamps
  - bayhead
  - brushland

  Nonwooded
  - wet prairie
  - deep freshwater marsh
  - salt marsh
  - artificially created marsh
- Water (166,570 acres)

Hardee County Environmental Systems

The Florida Department of Natural Resources (1975) has identified 15 environmental systems in Florida. Four of these systems--sand pine scrub, sandhills, pine flatwoods, and swamp forests--occur in Hardee County. The vegetative characteristics of these four environmental systems are described below:

Sand Pine Scrub. The sand pine scrub community is typically two-layered, with sand pine occupying the top layer and various oaks and other shrubs making up a thick understory. Herbaceous ground cover is very sparse or absent, and large areas of white or gray sand normally occur throughout the community. Understory plants include myrtle oak, sand-live oak, Chapman's oak, Rosemary, and gopher-apple.

The sand pine scrub is essentially a fire-based community. Fires allow for regeneration of the sand pine community, which would otherwise develop into a hardwood community through natural succession. Within Hardee County, the latter only occurs near the eastern border of the county.

Sandhills. The sandhills community occurs on well-drained white to yellowish sands. The sands are usually deep and relatively sterile, but contain more organic matter than the sands of the sand pine scrub community. Because of low soil fertility, low moisture availability, and fire, this community has a low tree diversity. Longleaf pines form a scattered (30 to 100 trees per acre) overstory in mature natural stands. In areas where the pines have been logged and the implementation of fire controls has eliminated periodic fires, the overstory consists primarily of xeric oaks such as turkey oak and southern red oak. In natural stands the oaks form a relatively open understory, and herbaceous plants such as wiregrass and yellow foxglove provide fairly complete groundcover.

Fire is the dominant factor in the ecology of this community. The interrelationships of the sandhill vegetation, particularly the longleaf pine-wiregrass relationship, are dependent on the occurrence of ground fires every two to five years. If periodic ground fires do not occur the longleaf pine will be succeeded by hardwoods. Very little of this community remains in Hardee County, for most of the areas which once supported it have now been planted in citrus groves.

Pine Flatwoods. The pine flatwoods community forms the most abundant natural system in Florida and are the most abundant of the environmental systems found in Florida. Most flatwoods occur on the level areas, or terraces, between ancient shorelines. These areas were covered by shallow seas at different times during the earth's history, and layers of sand were deposited at those times. These poorly drained marine sands were deposited in varying ways and have been sorted and weathered differently, partially accounting for the different types of flatwoods.

The soils of flatwoods areas are characterized by an acidic hardpan, one to three feet beneath the surface, which reduces percolation of water downward (during rains) and upward and also impedes root penetration during droughts. Though the soil is basically sandy, there is usually a moderate amount of organic matter in the top few inches.

There are three main types of flatwoods in Florida, each dominated by the species for which it is named. Longleaf pine flatwoods are found on better drained sites; slash pine flatwoods occur in areas of intermediate wetness; while pond pine flatwoods occur in areas which are more poorly drained areas.

The pine flatwoods community has a low diversity of tree species. Though understory shrubs and trees vary among the three major types of flatwoods, many plants are common to all flatwood communities. Common understory plants include wiregrass, saw palmetto, wax-myrtle, gallberry, and fetterbush. Cypress domes, bayheads, or small titi swamps usually occur throughout the community.

Fire and water are the two main determinants in the ecology of flatwoods. Slash pine flatwoods are subject to the least moisture stress of the three flatwoods types and have the highest species diversity. Fire is instrumental in reducing competition from hardwoods, but it generally does not occur often enough to kill the young, fire-sensitive slash pines.

Longleaf pine flatwoods are stressed by a relative lack of water, which reduces the plant diversity. Fire is very important in hardwood suppression and, in nature, occurs every few years. The longleaf pine is particularly well adapted to fire and is immune to ground fires at almost all stages of growth. In fact, successful natural regeneration of longleaf pine is dependent on fire to provide a suitable seedbed for germination and to control brown spot disease, which causes heavy seedling mortality.

Pond pine flatwoods are so stressed by excess water that they have the lowest diversity of the three communities. Fire is still important, and occurs at approximately fifteen to twenty year intervals. As in the other flatwoods, it reduces hardwood competition.

Swamp Forests. The swamp forest community is found bordering rivers and in basins where the forest floor is saturated or submerged during part of the year. Other terms for this community are floodplain forest, hydric hammock, and river swamp.

This community is characterized by large hardwoods such as blackgum, water tupelo, pop ash, red maple, sweetgum, water oak, and water hickory. Other typical overstory trees are bald cypress and cabbage palm. Understory trees include buttonbush, dahoon, wax-myrtle, American hopbeam, and elderberry. A high percentage of plants, particularly the overstory trees, are deciduous mixed hardwood swamps. Swamp forest productivity and species mixtures are determined to a large degree by the kind or condition of alluvial soil deposits.

The periodic flooding of the river swamps is a dominant factor in the operation of the system. These floods provide pulsed subsidies of nutrients to the system. The periodic flooding and drying is essential to the system, with new communities taking over if the land is either drained or flooded for long periods of time. In Hardee County this community is found along the floodplain of the Peace River.

9.1.2 PRINCIPAL FARMLAND SITE VEGETATION ASSOCIATIONS

Eight Florida Land Use and Cover Classification System (FLUCCS) vegetation associations* or types occur on the Farmland site (Farmland 1979). The distribution of these types on the site is shown in Figure 9-1; the acreage occupied by each is shown in Table 9-1. The species composition of the vegetation types as determined from floral surveys conducted in 1977 and 1979 is presented in Table 9-2. A total of 71 taxa of trees, shrubs, or woody vines; 183 taxa of herbaceous plants; and 11 species of epiphytes were identified.

Agriculture is the predominant existing commercial activity on the site. Nearly 56 percent (4333 acres) of the site has been drained and/or cleared for development of improved pasture, truck farming, or citrus groves. The citrus groves have been established on the highest and driest portions of the site. Most of the property that has been converted into improved pasture was originally occupied by pine flatwoods. Most of the remaining pine flatwoods and other upland forest types on the site (about 1725 acres) are also heavily grazed by cattle. The least disturbed natural vegetation associations on the site are the wetlands bordering stream courses. Many of these areas, which occupy about 1600 acres of the site, are also subjected to heavy grazing pressure from cattle.

The general characteristics of the onsite vegetation associations are discussed below. This discussion is based on information compiled by Environmental Sciences and Engineering, Inc. (ESE) and reported by Farmland (1979).

Pine Flatwoods and Palmetto Rangeland

Longleaf pine and live oak are the dominant species of the pine flatwoods, with saw palmetto, persimmon, and gallberry dominating the

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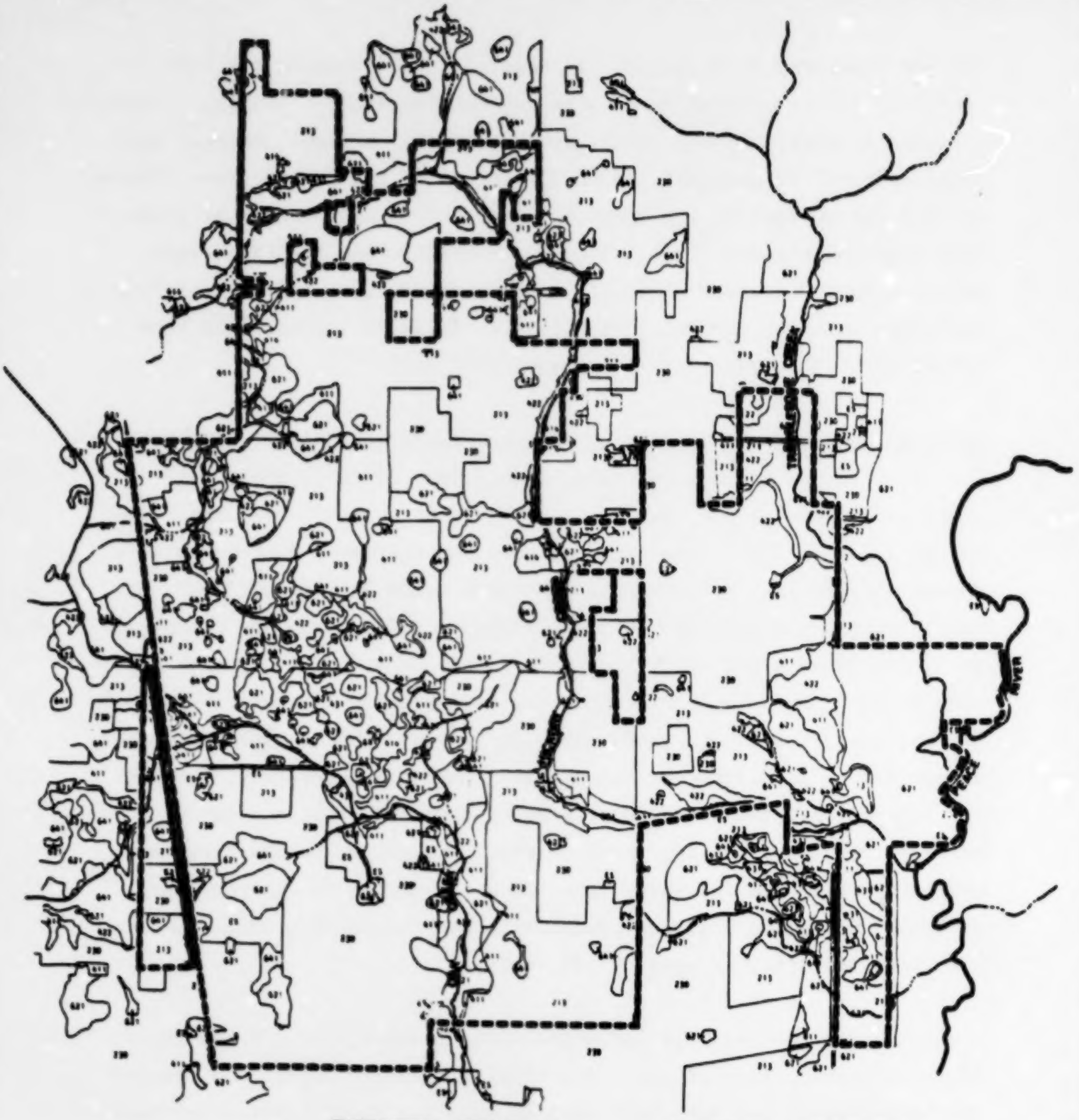
*Developed by the Florida Division of State Planning (1976).



FLUCCS CATEGORY	VEGETATION TYPE	FLUCCS CATEGORY	VEGETATION TYPE
100	URBAN OR BUILT-UP	422	OTHER HARDWOOD UPLAND FOREST
213	PASTURE	431	MIXED UPLAND FOREST
230	CITRUS GROVES	621	FRESHWATER SWAMP
411	PINE FLATWOODS-PALMETTO RANGE	641	FRESHWATER MARSH
414	OTHER CONIFEROUS UPLAND FOREST	53(262)	EARLY SUCCESSIONAL (OTHER AGRICULTURAL)

FIGURE 9-1. VEGETATION TYPES BASED ON FLUCCS.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

low and scattered shrub layer. In general, the flatwoods are now scattered and of limited stand size due to clearing and grazing. Canopy coverage in virtually all stands is less than 25 percent, whereas saw palmetto cover is generally 30 to 80 percent of the ground area. Timber and habitat potentials are generally low, except in the sizable rangeland areas of the Oak Creek Islands. In these areas the thick vegetative growth, interspersion with other associations, and the relative isolation maintain community structure in spite of recent fires, the latest of which occurred in early spring of 1977.

Mesic Hardwoods Forest (Upland Hardwood, Mixed, and Coniferous Forests)

This community includes three categories listed in Table 9-1: other coniferous upland forest, other hardwood upland forest, and mixed upland forest. These areas generally do not represent well-defined communities onsite, but occur as scattered hammocks, transitional ecotones, and successional stages between pine flatwoods and swamps, or as narrow bands along creek borders and marshes dominated by live oak, cabbage palm, and sweetgum. The three variants are distinguished by the proportions of pines and hardwoods. In general, the earlier successive stages are characterized by pines with a hardwood understory, whereas the climax mesic hammock is dominated by oaks and cabbage palms. Although species diversity, tree density, and volume (basal area) are greater than in the flatwoods, grazing has resulted in an open understory and depauperate ground cover, with lowered habitat value and community stability in most stands onsite.

Quantitative sampling conducted along transects by ESE has shown that the western edge of the Peace River floodplain forest and much of the hardwoods in the Oak Creek Islands area are mesic hardwood ecotones of upland characteristics, rather than wetlands or wetland transitional areas. These ecotones currently serve as buffers around the more sensitive wetland areas. Although also disturbed by fire, the Oak Creek Islands area contains many old-age live oaks and well-developed vegetation in every strata.

Freshwater Swamp

The freshwater swamp association on the Farmland site consists of mixed hardwood swamps and bayheads. These are described in greater detail in the following paragraphs.

Mixed Hardwood Swamps. Mixed hardwood swamps and floodplain forests comprise the majority (66 percent) of the freshwater swamp type on the mine site. In these areas, cabbage palm, diamondleaf oak, and sweet gum dominate an essentially floodplain forest. Mixed hardwood swamps generally differ from the mesic hardwood forest in the decreased occurrence of live oak and the increased occurrence of wetland species such as water hickory, water locust, bald cypress, and American elm. In general, the dominant species are those with tolerance to a wide range of moisture conditions. Within the Oak Creek Islands area, hardwood swamp vegetation consists primarily of two variants. Along a portion of the Oak Creek channel, cabbage palm forms almost a pure stand. Throughout the northern portion of this area, in the vicinity of the poorly defined drainage pathways, sprouted or coppaced Carolina ash trees form dense stands in the depressions.

Table 9-2 shows that the hardwood swamps have the greatest diversity of flora. Although the dominant species are currently in a healthy state, a successional trend to more mesic species is occurring on the property, particularly in the Oak Creek Islands area and along Hickory Creek, where channel diversion and channelization respectively have altered the moisture status. The primary stress currently associated with the Peace River Swamp probably is the reduction of shrub and groundcover vegetation by grazing.

Bayheads. Bayheads (hydric hammocks), which range from 1 to 45 acres in size on the mine site, are dominated by either a swamp bay/sweet gum association or a sweet bay/red maple association. Bayheads account for 34 percent of the freshwater type on the mine site. Although these areas generally have a low species diversity, the higher quality stands contain many uncommon groundcover and epiphytic species, particularly ferns. The better stands have high timber biomass and relatively old trees.

Bayheads on the mine site have been greatly influenced by existing drainage and grazing practices. Well developed bayheads occur in the drainage basin north of Oak Creek Islands, Sections 3, 4, and 34. A relatively pristine bayhead also occurs in the northeast quarter of Section 12. The bayheads of the remainder of the mine site have been damaged by drainage, fire, and cattle usage.

Freshwater Marsh

Marshes on the mine site are generally less than 5 acres in size and have been adversely affected by past drainage and grazing practices. Two larger marshes (61 and 40 acres) do occur in Section 27. These two were the only marshes on the mine site which contained standing water throughout both the 1977 and 1978 dry seasons.

The marshes adjacent to wooded areas contain a high percentage of sawgrass cover, as opposed to smartweed and maidencane dominance in the larger open marshes, or a dominance of short grasses and sedges in the wet prairies of the pastures.

Groves, Pastures, Old Fields

Pastures, groves, and old fields are all dominated by similar associations of early successional "weedy" groundcover species, cultivated pasture grasses, and invader species from adjacent marshes and flatwoods. Species diversity is very low in pastures, but can be fairly high in groves and associated old fields.

9.1.3 ONSITE FLOODPLAINS AND WETLANDS

The previous section included a discussion of the general wetland vegetation types present on the Farmland site. This section provides a more detailed description of these wetlands based upon dominant species listed in the FLUCCS. The distribution of these wetland sub-categories is shown in Figure 9-2, and the acreage of each on the Farmland property is shown in Table 9-3. The 100-year floodplains are shown in Figure 9-3. It can be seen that much of the land lying within the boundaries of the 100-year floodplains does not support wetland types as defined under the FLUCCS. A detailed description of the wetlands on the mine site property has been compiled by Farmland (1979). The following discussion is taken from this description.

> "The eastern portion of the mine site (east of State Road 661) drains into Troublesome Creek and Peace River through a well-developed mixed hardwood swamp. This area is generally dominated by trees of wide moisture tolerance such as diamondleaf oak, sweet gum, and cabbage palm. True wetland tree species dominate only in the portion nearest to the stream channels and sloughs, therefore, this forest is characterized as a bottomland or alluvial river floodplain forest.
>
> Upland species dominate the western boundary of the swamp and form an ecotone or buffer strip approximately 300 to 1000 feet in width to the 36-foot contour level along the Peace River. A steep slope between Troublesome Creek and the citrus groves in Section 1 has resulted in substantial groundwater seepage and wetland development at the upper edge of the system in this area.
>
> The Peace River-Troublesome Creek forest has high value because of its high species diversity, high biomass, unique habitat value, and the presence of large, old-age trees sheltering a mature and complex community. The floodplain forest also provides the Peace River with a substantial area for sediment release, energy dissipation, and additional storage volume.
>
> Hickory Creek, which drains a narrow basin in the central portion of the mine site, is characterized in most places by a narrow, deeply incised channel. The wetlands in this system are generally restricted to a narrow border of mixed hardwood or to a floodplain swamp less than 500 feet in width. Because of the steep gradient, the highly channelized nature, and the high conductivity of this stream, flooding is generally of short duration with little deposition of sediment or organic matter outside of the channel. Dredging the channel has resulted in a successional trend to more mesic species in the area adjacent to State Road 661. Much of the functional nature of these wetlands has been lost due to channelization, drainage alteration, and extensive development of adjacent uplands. The lower regions of Hickory Creek perhaps should be considered a functional part of the Peace River floodplain rather than of the upper Hickory Creek system.

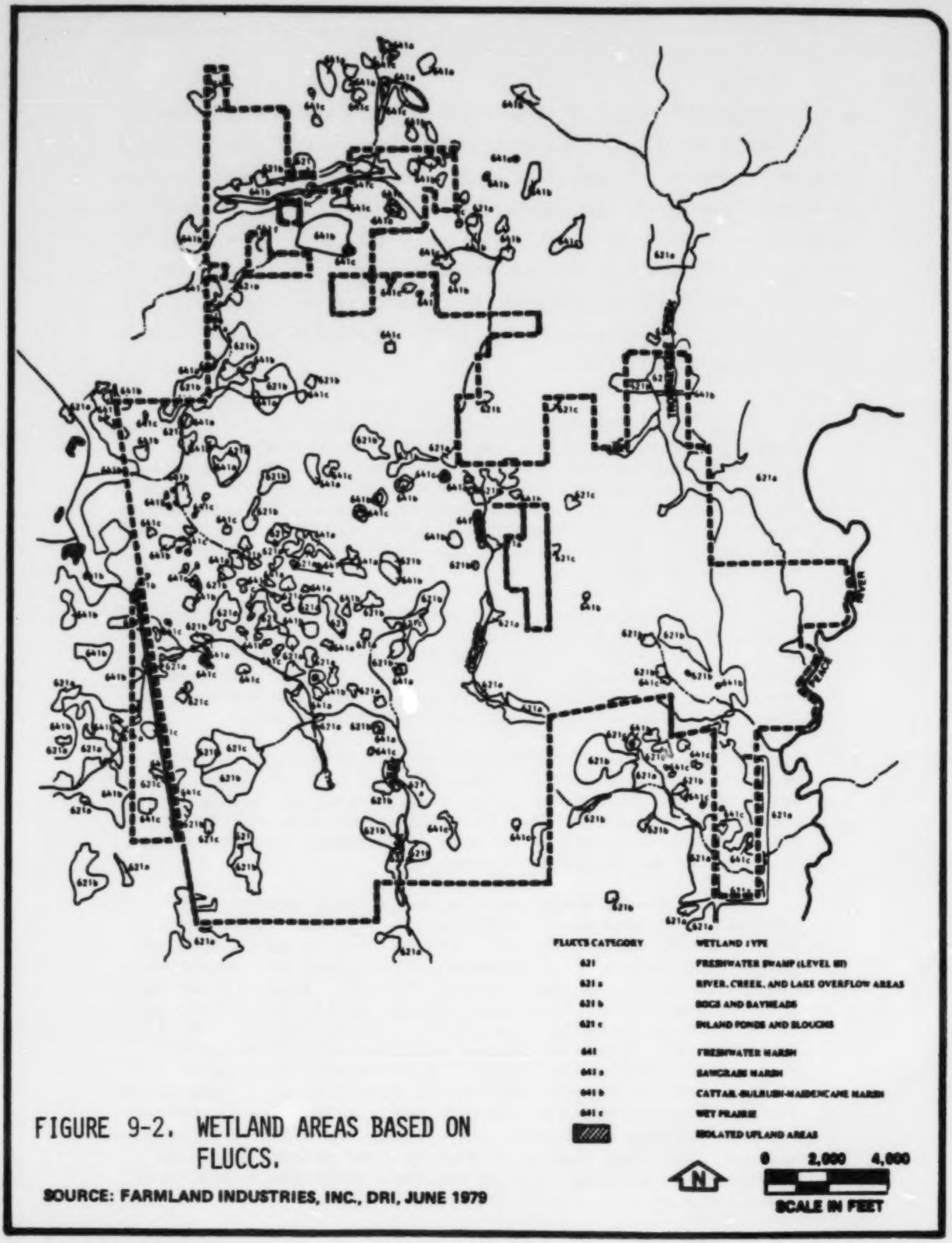


FIGURE 9-2. WETLAND AREAS BASED ON FLUCCS.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

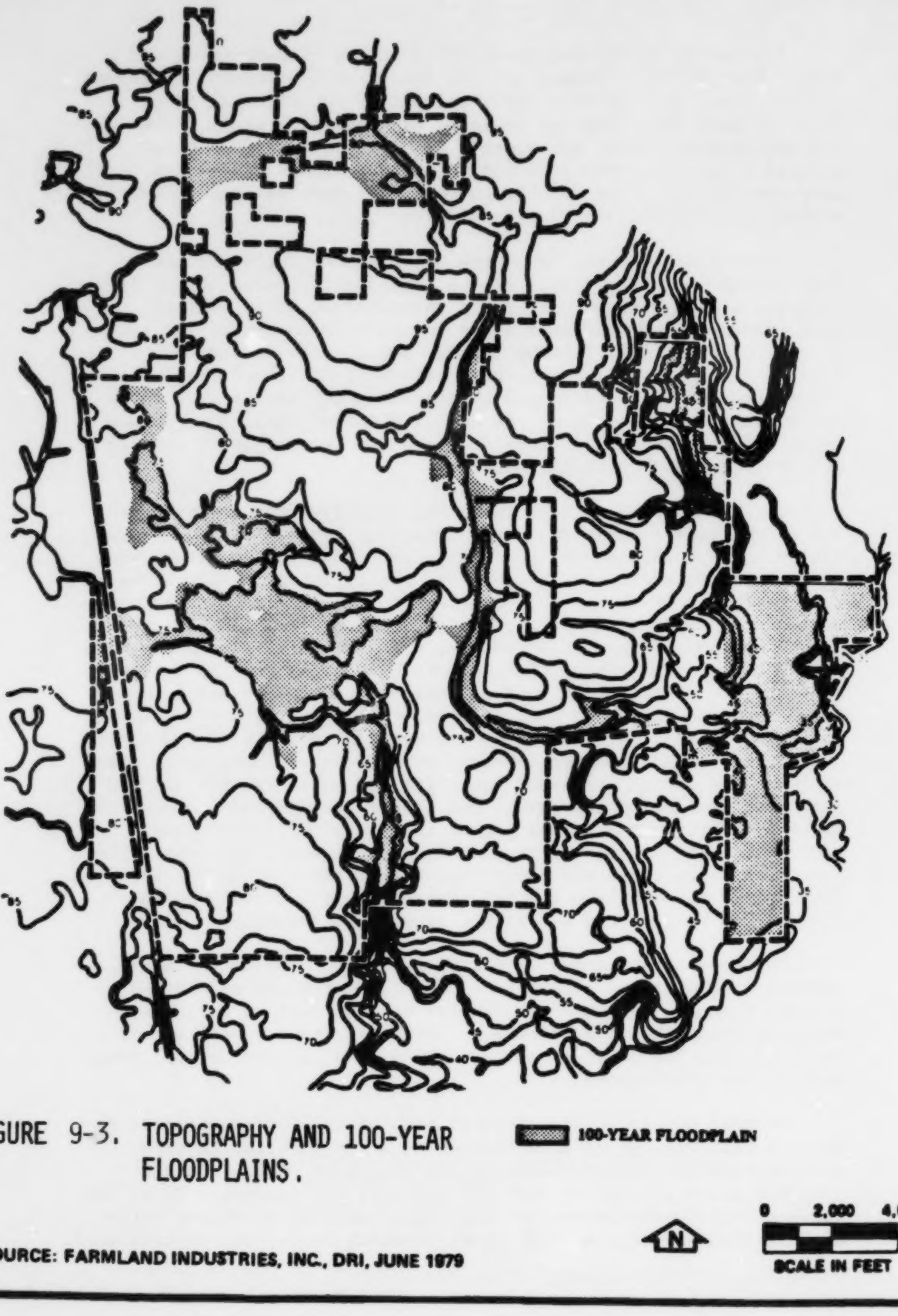


FIGURE 9-3. TOPOGRAPHY AND 100-YEAR FLOODPLAINS.

▨ 100-YEAR FLOODPLAIN

N

0 2,000 4,000

SCALE IN FEET

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

Because of the well-drained soils in the Hickory Creek and Peace River drainage basins and the intensive development of groves and pastures, few wetlands exist outside of the floodplains in these basins. The existing wetlands are basically small bayheads and wet prairies which are greatly disrupted by cattle. Other wetland areas have been affected by grove drainage systems so that they consist mainly of shrubby successional species such as Carolina willow, buttonbush, and Florida elderberry.

The Oak Creek basin is a more natural and poorly drained system than the eastern half of the mine site. Consequently, it contains a more diverse and highly interspersed assortment of wetland types from headwater areas to the main channel. The lower portion of Oak Creek, flowing through a well-defined channel between citrus groves, is bordered by a well-developed band of mixed hardwood swamp dominated by species which have a wide range of tolerance, such as water oak and diamondleaf oak. Depressions bordering the channel and receiving seepage from adjacent uplands are characterized by bayhead species.

Oak Creek apparently receives major inflow from its present course and from a drainage system extending east of Ona and flowing into Oak Creek Islands on the north. Various drainage alterations and reduced rainfall have lowered the contribution of this tributary so that most of the current flow of Oak Creek goes through a well-defined channel along the southern edge of the islands. Oak Creek Islands consists of a complex, highly interspersed group of upland and wetland communities, generally grading from pine flatwoods on the east through successional mesic hardwood stages to mixed hardwood swamp and cabbage palm hammock in the northwest. Reduction in flow into the dissected drainage pattern of the north end of the islands appears to have resulted in a successional trend of increased upland species. Sweet gum and oaks have invaded the flatwoods whereas upland shrubs and annual species have invaded the marshes. Marshes and swamps appear to be limited to depressed areas which may be related to underlying geologic conditions. The swamps in these areas are composed primarily of coppaced or sprouted forms of Carolina willow and buttonbush. Drying conditions and fire may be responsible for maintaining this community.

Wetlands to the north of Oak Creek Islands consist of marsh/bayhead systems from 7 to 23 acres in size which are maintained by seepage from the surrounding pastures and thus act as springheads draining into Oak Creek Islands. Currently, the bayheads appear to be succeeding the sawgrass marshes which occur in the deeper, lower ends of the depressions.

Another important wetland area lies north of State Road 64 in Section 27. The two marshes (61 and 40 acres in size) in this section were the only wetlands on the mine site which retained standing water throughout the 1977 and 1978 dry seasons. These two marshes contained numerous species characteristic of a deep marsh such as bladderwort, parrotfeather, floating heart, and pickerelweed.

> Numerous smaller marshes occur as isolated depressions throughout the basin. Where water level seldom rises above three inches, the marshes can best be described as wet prairie with spikerushes, beakrushes, whitetop sedge, smutgrass, and pasture grasses dominant. Many of these areas are barely recognizable low areas in pastures. Deeper marshes are dominated by smartweeds, maidencanes, soft rush, arrowheads, and numerous other species. When the marshes are surrounded by wooded areas, sawgrass is often dominant."

9.1.4 WILDLIFE

The wildlife of western peninsular Florida includes 27 species of amphibians, 67 species of reptiles, 370 species of birds, and 51 species of mammals (Layne, et al. 1977). A review of regional records compiled by ESE and reported by Farmland (1979) indicates that 22 species of amphibians, 47 species of reptiles, 210 species of birds, and 40 species of mammals are likely to occur in Hardee County.

Farmland (1979) reports the occurrence of 164 species of wildlife on or in the vicinity of the site (Table 9-4), with the greatest abundance of wildlife species on the site being those which utilize forested swamp and hammock areas for cover and nesting, and forage in the more open wetlands, pastures, groves, and rangeland; or species whose optimum habitat is that provided by the transition zone (ecotone) between forest and openland.

Principal Wildlife Habitats

At the present time four principal wildlife habitats are found on the site. These habitats are classified as follows: ruderal (rangeland, pasture, and citrus groves)--5423 acres; forest (hammocks and floodplain)--790 acres; wooded swamp (bayheads and swamps)--1205 acres; and freshwater marshes--392 acres. These habitats are further described in the following paragraphs.

Ruderal Habitat. Approximately 69 percent of the site is occupied by this habitat type. The vegetation types included in this classification are citrus groves, improved pasture, pine flatwoods/palmetto range, and early successional stages. This habitat is created as the result of continual modification of the natural plant communities for agricultural purposes and, consequently, this habitat has the least value to wildlife of the four principal habitats on the site. Species typically occurring in this habitat included the mourning dove, cattle egret, Florida sandhill crane, common crow, loggerhead shrike, Virginia opossum, raccoon, nine-banded armadillo, white-tailed deer, wild hog, eastern cottontail, and fox squirrel. Wildlife species were most frequently observed in portions of this habitat in close proximity to the other less disturbed habitat types.

Forest Habitat. Forest habitat covers approximately 10 percent of the site. Hammocks and forested floodplain are included in this classification but bayheads and forested swamps are not. About 53 percent of the area classified as forest habitat is supporting a hardwood forest and the remaining 47 percent is supporting a mixed hardwood and coniferous or pure coniferous forest. This habitat is used to some extent by the majority of wildlife species occurring on the site. The forest habitat provides essential escape cover and travel corridors for species foraging in the more open ruderal habitat, and also provides nesting cover for many of the resident bird species. Species typically occurring in this habitat included the yellow-billed cuckoo, pileated woodpecker, red-bellied woodpecker, downy woodpecker, blue jay, tufted titmouse, Carolina wren, white-eyed vireo, gray squirrel, nine-banded armadillo, and white-tailed deer. The forests on the Peace River floodplain and Oak Creek Islands provide the best forest habitat for wildlife on the site.

Wooded Swamp Habitat. This habitat is comprised of the bayheads and hardwood swamps which are scattered throughout the site region and occupy about 15 percent of the total site area. These scattered swamps and bayheads are often surrounded by extensive pasture or rangeland and thus provide essential cover for wildlife foraging in the pastures and rangeland. Species frequently observed in this habitat included the white-tailed deer, raccoon, wild hog, pileated woodpecker, and blue jay. Trapping of the bayheads and hardwood swamps indicated that these areas supported a higher density of small mammals in comparison to the other habitats on the site. The apparent higher population density of small mammals may be attributable to a lower level of livestock grazing in this habitat as compared to the intensity of grazing in the other habitats in which trapping was undertaken.

Freshwater Marsh Habitat. Freshwater marsh occupy about 5 percent of the site area. Draining, fire prevention, and other agricultural activities have probably had an effect on the ecology of the marshes on the site. Although the onsite marshes are small and do not appear to attract large aggregations of feeding wading birds, they do provide habitat for many wildlife species including the rice rat, cotton rat, marsh rabbit, otter, wild hog, white-tailed deer, and wood duck.

Game and Commercial Furbearing Species

The site provides habitat for a variety of game and commercial furbearing species. The most abundant species are generally those whose habitat is formed by early successional stage plant communities (e.g., agricultural lands, second growth brushlands) or forest communities (e.g., Peace River floodplain, hardwood swamps). Farmland (1979) reports that the commonly occurring game and commercial furbearing species on the site are the eastern cottontail, Virginia opossum, bobcat, raccoon, gray squirrel, wild hog, white-tailed deer, bobwhite, mourning dove, and wood duck. Other less commonly occurring species include the marsh rabbit, Sherman's fox squirrel, red fox, gray fox, striped skunk, river otter, king rail, wild turkey, and mottled duck.

9.1.5 ENDANGERED, THREATENED, AND PROTECTED SPECIES - VEGETATION

Federal

None of the plant species presently listed by the U.S. Department of Interior (USDI) (1980a) as endangered or threatened occur in Florida. However, the USDI (Fish and Wildlife Service) is conducting a review of 84 Florida plant species that have been proposed as being endangered and

128 species that have been proposed as being threatened (Texas Instruments, Inc. 1978). However, it is unlikely that any of these species will be designated as endangered or threatened in the foreseeable future (USFWS 1979).

State

Florida Statute 581.185 (Preservation of the Native Flora of Florida) provides for the protection of native plant species which although not endangered or threatened are being reduced in abundance within the state due to collecting. The law provides for the issuance of a permit before these species can be legally collected, transported or sold (Ward 1979).

Nongovernmental

The Florida Committee on Rare and Endangered Plants and Animals (FCREPA) has published its own classification of endangered or threatened Florida plants. This committee is sponsored by the Florida Audubon Society and Florida Defenders of the Environment in cooperation with the Florida Game and Freshwater Fish Commission. None of the plant species listed as endangered or threatened by the FCREPA are known to occur on the site. However, the FCREPA (Ward 1979) indicates that the range of 8 species on its list includes Hardee County. A review of plant records at the University of Florida conducted by ESE and reported by Farmland (1979) suggests that another 8 species listed by the FCREPA occur in contiguous counties with habitats similar to those present in Hardee County. These species and a subjective rating of the likelihood of their occurrence on the site (as reported by Farmland) are shown in Table 9-5.

Coontie, Hartwrightia, needle palm, and spoon-flower have been previously collected from Hardee County, and are thus the only species listed in Table 9-5 that are considered to have a moderate likelihood of occurrence onsite. The likelihood of occurrence of all the other species is rated as being low, or very low because they are: (1)

associated with white sand scrub habitats of the central Florida Ridge which is found primarily in counties east of the site; and/or (2) the species have not been collected in Hardee County.

9.1.6 ENDANGERED AND THREATENED SPECIES - WILDLIFE

A total of 33 species of animals that have been designated by Federal and State agencies and private citizen groups as endangered, threatened, rare, or of special concern have ranges that include the proposed project site (Table 9-6). Eighteen of these species have been observed on or near the Farmland site (Table 9-7).

Federal

In May 1980, EPA provided the U.S. Fish and Wildlife Service (USF&WS) Jacksonville, Florida office with a description of the Farmland project and requested a list of endangered and threatened species which might occur in the project's area of influence. USF&WS responded to the EPA request with the following listing of species believed to be present in the area (USF&WS 1980):

Bald eagle - Endangered
Red-cockaded woodpecker - Endangered
American alligator - Threatened
Eastern indigo snake - Threatened
Arctic peregrine falcon - Endangered

The occurrence of several of these species in the area was documented during field studies for the Farmland project. The observations were as follows:

Species	Habitat/Location	Status
American alligator	Peace River and Hickory Creek	Threatened
Eastern indigo snake	Two (2) sightings in mesic woodlands on the site; one (1) road-killed adjacent to citrus grove on the site.	Threatened
Southern bald eagle	One (1) sighting over a freshwater marsh on the site and one (1) sighting near the Peace River.	Endangered

All but the bald eagle are believed to be resident on the Farmland site. Figure 9-4 shows the locations of sightings of endangered and threatened species on the Farmland property.

The Florida panther is an additional endangered species which could occur in the area, but there have been no recent sightings of this species in Hardee County.

No areas in Hardee County have been designated as Critical Habitat for any of the species considered to be endangered or threatened by the USDI.

State

Like the USDI, the Florida Game and Freshwater Fish Commission (FG&FFC) has determined that certain species are endangered or threatened (FG&FFC 1979). There are, however, differences in the classifications of given species listed by both agencies, as well as the actual species listed (Table 9-6).

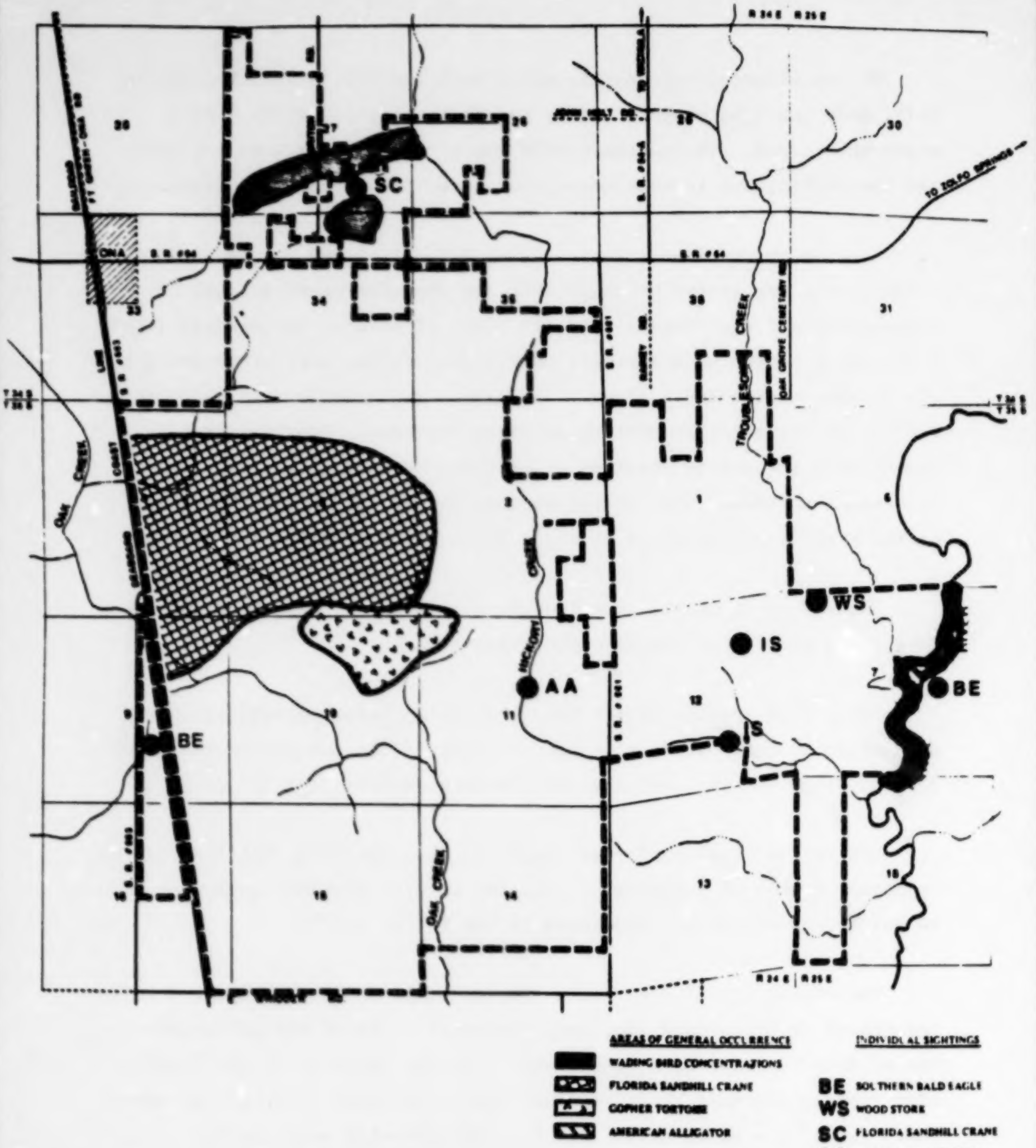


FIGURE 9-4. SIGHTINGS OF ENDANGERED OR THREATENED SPECIES.

SOURCE: FARMLAND INDUSTRIES, INC., DRI. JUNE 1979
(MODIFIED BY WOODWARD-CLYDE CONSULTANTS)

Of the observed species listed by both the USDI and FG&FFC (Table 9-7), only one (the eastern indigo snake) is classified the same by each--threatened. The southern bald eagle is listed by both the USDI and the FG&FFC, but is considered endangered and threatened, respectively.

Species observed on the site which are not listed by the USDI (1980b), but are listed by the FG&FFC are the wood stork (listed as endangered) and the Florida sandhill crane (listed as threatened) (Table 9-7). Wood storks were most frequently seen flying over or roosting in the forests of the Peace River floodplain. Individuals were observed feeding on the site; no nesting activity was seen. Florida sandhill cranes were frequently observed on or near the site in pastures and freshwater marshes. The osprey, another species listed as threatened by the FG&FFC, was observed over the Peace River near the site.

Figure 9-4 shows the locations of sightings of endangered and threatened species on the Farmland properties.

Other bird species listed by the state as being threatened which have recently been observed in Hardee County (although not on the site) are Audubon's caracara and the southeastern kestrel.

Central and eastern Hardee County is also listed by Williams (1978) as being an area of principal population for the Florida black bear, a mammal considered to be threatened by the FG&FFC (1979).

The FG&FFC (1979) also lists species which are not considered to be endangered or threatened, but are considered to be of special concern. Six of these species have been observed in the vicinity of the Farmland site--namely the American alligator, gopher tortoise, little blue heron, snowy egret, Louisiana heron, and Florida burrowing owl. As indicated previously, the American alligator is considered to be threatened by the USDI. An additional one of these species, the gopher tortoise, has been shown to be strongly associated with the threatened eastern indigo snake (Speake, et al. 1978). McDiarmid (1978) states that gopher tortoise burrows constitute a critical factor necessary for the survival of the indigo snake in areas of limited moisture. The principal area of occurrence of the gopher tortoise on the Farmland site was the Oak Creek Islands area.

Nongovernmental

The FCREPA has published its own classification of endangered or threatened Florida species (Kale 1978; Layne 1978; and McDiarmid 1978). Species on the FCREPA list that were observed in the vicinity of the Farmland site are listed in Table 9-7. These species include all of those listed by the USDI and FG&FFC which were observed on or near the site plus seven additional species. The additional species and their classifications are as follows:

Rare	Threatened	Special Concern
Roseate spoonbill	Sherman's fox squirrel	Great egret
		Black-crowned night heron
		Yellow-crowned night heron
		White ibis
		Hairy woodpecker

Species Requirements and Population Status

A summary discussion of each of the above observed species' habitat requirements and the status of their populations in the site region is presented below.

American Alligator (F-T, S-S, NG-S)*. The alligator is an inhabitant of river systems, canals, lakes, swamps, bayous, and coastal marshes. The alligator is a commonly occurring species on the site, and Layne, et al. (1977) reported the species to be generally common throughout the western peninsular Florida region. Alligator populations have been increasing substantially from the low levels reached in the late 1950's and early 1960's. The U.S. Fish and Wildlife Service currently estimates the Florida population to be slightly in excess of 400,000 (USFWS 1979).

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*See Table 9-6 for explanation of code letters in parentheses.

Gopher Tortoise (S-S, NG-T). The gopher tortoise is an inhabitant of live oak hammocks, sand pine scrub, pine-turkey oak, and various successional types of xeric ruderal habitats. Its principal habitat requirements include dry, well-drained sandy soils and good herbaceous cover on which to feed. Most of this type of habitat on the site has been converted to citrus groves and the gopher tortoise is an uncommon species on the site. Layne, et al. (1977) reported the species to be generally common in western peninsular Florida region wherever its preferred habitats are found. The gopher tortoise population is believed to be in a long-term decline because of continued destruction or modification of its preferred habitat. Layne, et al. (1977) cited an unpublished masters thesis as indicating that the gopher tortoise population of Hardee County was estimated at 400 in 1973.

Eastern Indigo Snake (F-T, S-T, NG-S). The indigo snake occupies a variety of habitats ranging from dry, sandy pine oak communities to moist tropical hammocks. The species is most suited to mesic environments, and its common occurrence in sandhills and other xeric habitats is possible only where gopher tortoise burrows and other subterranean cavities are available for shelter from the heat (McDiarmid 1978). In the Hardee County region it has been recorded most often from live oak hammocks, old fields, pine flatwoods, and oak-pine sandhills (Layne, et al. 1977). Gopher tortoise burrows and other subterranean cavities are commonly used as dens for egg laying by the indigo snake, and the continuing decline of the gopher tortoise is probably having an adverse effect on indigo snake populations. The indigo snake appears to be a commonly occurring species on the site. Layne, et al. (1977) reported the species to be generally uncommon throughout the western peninsular Florida region. The indigo snake population appears to be in a continuing decline because of habitat loss and illegal collection by snake fanciers or merchants.

Wood Stork (S-E, NG-E). The wood stork nests only in trees over standing water or islands. It forages in freshwater and brackish wetlands and will travel as much as 60 miles to secure food for nestlings. Preferred feeding sites are freshwater marshes, flooded pastures, and ditches. The species survival is dependent upon vast expanses of wetlands capable of producing local concentrations of fish through established patterns of drying and flooding (Layne, et al. 1977). The wood stork is a commonly occurring species on the site. Layne, et al. (1977) report the wood stork as being uncommon in the western peninsular Florida region. An active nesting colony is located in Hardee County 20 to 30 miles east of the site. The wood stork population appears to be in a steep decline presumably due to the continual draining or modification of extensive wetlands in Florida. Layne, et al. (1977) report that an estimated 650 pairs of breeding wood storks were present in western peninsular Florida in 1976. These pairs represent about 10 percent of the entire Florida breeding population.

Southern Bald Eagle (F-E, S-T, NG-T). The bald eagle is usually found in riparian habitats, associated with coasts, rivers, and lakes. The species usually nests near large bodies of water, although in interior Florida it will occasionally nest on marshes and ponds far from expanses of open water. The bald eagle occurs on the site as a transient and such occurrences are expected to be infrequent. The Florida bald eagle population has declined at least 50 percent in the last 30 years (USFWS 1979), and Layne, et al. (1977) estimated the total population for the western peninsular Florida region to be between 169 and 176. There are no known active bald eagle nest sites in Hardee County (USFWS 1979).

Florida Sandhill Crane (S-T, NG-T). The Florida sandhill crane prefers open habitats and is found primarily in wet and dry prairies, improved cattle pastures, and shallow marshes or lakes with sparse emergent vegetation surrounded by grasslands. Its nests are typically located in shallow waters of lakes, ponds, or marshes containing stands of pickerelweed, maidencane, and arrowleaf. The Florida sandhill crane is a commonly occurring species on the site. Layne, et al. (1977) report that the species is locally common in areas of suitable habitat in the western peninsular Florida region. These areas of suitable habitat include the extensive native prairie and improved pasturelands in Hardee, Charlotte, DeSoto, Manatee, and Sarasota Counties. Layne, et al. (1977) estimated the Florida sandhill crane population of western peninsular Florida as being between 400 to 600, which is about 10 percent of the total statewide population.

Little Blue Heron (S-S, NG-S). The little blue heron is an inhabitant of both coastal and inland wetlands. It prefers to forage in shallow vegetated areas, however, it will use a wide variety of wetland environments. Nesting colonies are usually located in trees and shrubs on islands or in standing water. The little blue heron is a common species on the site and is reported by Layne, et al. (1977) as being common throughout western peninsular Florida.

Snowy Egret (S-S, NG-S). The snowy egret is an inhabitant of freshwater and coastal wetlands with a preference for saltwater habitats. Breeding colonies are usually located in trees and shrubs on islands or in standing water including dead trees in slime ponds. The species is uncommon on the site although Layne, et al. (1977) report it to be common throughout western peninsular Florida.

Louisiana Heron (S-S, NG-S). The Louisiana heron is an inhabitant of freshwater and coastal wetlands. Breeding colonies are located on trees and shrubs on islands or over standing water and are usually associated with colonies of other herons. The species is uncommon on the site and Layne, et al. (1977) consider the species to be uncommon in the western peninsular Florida region.

Florida Burrowing Owl (S-S, NG-S). The Florida burrowing owl is a resident of grasslands and dry prairies or any well-drained sandy ground with little plant growth. Nests are established in burrows which the owl digs itself. The Florida burrowing owl is rare on the site and Layne, et al. (1977) consider the species to be uncommon in the western peninsular Florida region.

Great Egret (NG-S). The great egret utilizes most kinds of wetland habitats. It forages in shallow, quiet waters. Nesting colonies are located in trees and shrubs on islands and in flooded swamps. The species is common on the site and Layne, et al. (1977) report it to be common throughout western peninsular Florida.

Black-crowned Night Heron (NG-S). The black-crowned night heron is an inhabitant of both interior wetlands and estuaries. It feeds almost entirely at night, and hides in nearby trees and shrubs during the day. Nests are located in trees and shrubs on islands or in flooded swamps. The black-crowned night heron is uncommon on the site and Layne, et al. (1977) consider the species to be uncommon in the western peninsular Florida region.

Yellow-crowned Night Heron (NG-S). The yellow-crowned night heron is an inhabitant of both inland and coastal wetlands and shows a strong preference for saltwater habitats. It is often a solitary nester in both tall trees and shrubs. The yellow-crowned night heron is uncommon on the site and Layne, et al. (1977) consider the species to be only rare and local in the interior portions of the western peninsular Florida region.

White Ibis (NG-S). The white ibis will inhabit all wetlands, natural and artificial, that provide a soft substrate for foraging by probing. Nesting colonies are located on islands or flooded areas in trees and shrubs and on the ground. The white ibis is an abundant species on the site and Layne, et al. (1977) consider it to be the most abundant ciconiiform bird in Florida.

Roseate Spoonbill (S-S, NG-R). The roseate spoonbill is primarily an inhabitant of estuarine wetlands although it will occasionally visit inland wetlands. It is a rare species on the site and Layne, et al. (1977) report the Florida population as 2200 individuals. Several hundred roseate spoonbills are summer residents of Tampa Bay.

Osprey (S-T, NG-T). The osprey resides in the vicinity of the coast, interior lakes, large swamps, or large rivers where the fish on which it feeds are abundant. Nests are usually located in the tops of large trees or on man-made structures such as utility poles, radio towers, and channel markers. The osprey is an uncommonly occurring species on the site. Layne, et al. (1977) report the osprey to be locally common in the western peninsular Florida region. Declines in the osprey population have been attributed to pesticides, loss of habitat, and wanton shooting. Osprey populations are expected to stabilize or increase as the result of the government bans on the use of a number of long lived pesticides.

Southern Hairy Woodpecker (NG-S). The hairy woodpecker is a permanent resident in Florida. It occupies a variety of woodland habitats and shows a marked preference for stands of dead trees and for woodlands isolated from human habitations. The hairy woodpecker is uncommon on the site and Layne, et al. (1977) consider the species to be uncommon in the western peninsular Florida region.

Sherman's Fox Squirrel (S-S, NG-T). The primary habitat for the Sherman's fox squirrel is the longleaf pine-turkey oak or sandhills association which has been extensively eliminated by extensive logging. Within the western peninsular Florida region, the species is most frequently found in pine flatwoods or improved pasture areas with open pine stands that create a park-like environment. It is also found in live oak hammocks and occasionally in sandhills and sand pine scrub (Layne, et al. 1977). The Sherman's fox squirrel is an uncommon species on the site. Layne, et al. (1977) report it is rare to uncommon within the western peninsular Florida region although sighting records suggest that a relatively good population exists in the pine flatwoods and open live oak hammock habitats in western Hardee and DeSoto Counties and eastern Manatee County. Although listed as threatened by the FCREPA, the Sherman's fox squirrel can be legally hunted in Florida.

9.2 THE ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

The proposed mining and processing of phosphate rock at the Farmland site and subsequent reclamation of disturbed land will result in adverse impacts on the existing terrestrial ecology of the site. This section contains a description of the impacts on terrestrial ecology associated with the alternative methods of accomplishing the identified project goals. The discussion is arranged by project component so that the alternative methods for any given project component can be examined to an equal degree, thus providing a basis for comparison of alternatives. The first alternative discussed under each project component is Farmland's proposed action (Section 2.0). Only those components having impacts relating to terrestrial ecology are considered in this section. The last discussion within the section considers the terrestrial ecology impacts of the no action alternative as it applies to the project as a whole.

9.2.1 MINING

Dragline Mining (Farmland's Proposed Action)

Terrestrial biological communities will be affected by the following activities associated with dragline mining of phosphate at the Farmland site:

- clearing and grubbing
- excavation, mining, overburden deposition, and dewatering
- development of roads, railspurs, parking facilities, various settling ponds, and powerlines
- human activity associated with construction and operation activities

These activities will have direct physical impacts on the site's various biological communities. These impacts will also result in changes in the habitats present and, consequently, alter the area's wildlife populations.

Acreage Altered. Approximately 5280 acres (67.6 percent) of the 7810-acre mine property will be disturbed during the life of the mine. Mining will proceed at a rate of about 250 acres per year over the 20-year life of the mine. The specific land area requirements for components of the mine are presented in Table 9-8.

A corridor for dragline crossings will also be estabished in the unmined segment of Oak Creek downstream of the Oak Creek Islands. This will result in the removal of 10 acres of vegetation and will disrupt the habitat continuity of this otherwise undisturbed area.

Disruption of Site Area Land Uses. Land use types that will be removed for mining operations are shown in Table 9-8. The significance of the impact on the terrestrial ecosystem resulting from the removal of the various vegetative communities depends to a large extent on the overall portion of each community that will be removed. The freshwater swamp and marsh and upland forest communities provide a diversity of wildlife habitats and their loss will have a more significant effect on terrestrial ecology of the area than will the loss of the agricultural and range communities. The species diversity and productivity of each community affected, as well as its replaceability, are also important considerations in addressing the significance of the impact. The significance of the impact may also vary depending on whether it is considered from a regional or local perspective.

The regional significance of the anticipated impacts was assessed on the basis of the land use characteristics within Hardee County as described in the report titled "Natural Resource Factors Comprehensive Plan Hardee County, Florida" (Adley Associates, Inc. 1979). All of the communities that will be affected by the construction and operation of the mine are common in the county. The proposed development will result in the eventual removal of 1757 acres (2.5 percent) of the 68,838 acres of citrus groves or nurseries; 583 acres (0.4 percent) of the 145,195 acres of herbaceous (palmetto) range; 2055 acres (2.0 percent) of the 102,653 acres of the pasture/cropland; 280 acres (10.3 percent) of the 2714 acres of upland forestlands*; and 605 acres (0.8 percent) of the 78,200 acres of wetlands in Hardee County. Much of the loss of these plant communities will occur gradually over the life of the mine, so that the overall impact will be mitigated by ongoing reclamation (see Section 2.6). From a regional perspective, the construction and operation of the facility will only remove a small percentage of the total amount of the affected communities found in Hardee County. This loss would become more significant, however, if the cumulative losses of these communities due to possible future mining and development in the county are considered.

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*Within Hardee County, upland forests and forested wetlands together total about 78,600 acres.

The loss of the natural vegetative communities (e.g., upland forest, wetlands, pine flatwoods/palmetto range) will have a greater impact on terrestrial ecology than will the loss of the agriculturally managed lands (e.g., pasture, cropland, citrus groves). The only long-term loss of communities (assuming that the reclamation plan is successfully completed) will be the loss of about 30 percent of the site's pine flatwoods/palmetto range and wetlands communities (583 acres of pine flatwoods/palmetto range and 207 acres of wetlands). Reclamation plans provide for the reestablishment of 339 acres of freshwater marsh and 59 acres of freshwater swamp. Because of the low relief topography, attendant drainage patterns of wetlands and associated hydric soils of wetlands are difficult to restore; therefore, the floristic composition of the restored wetlands is likely to be less diverse and different from the natural wetlands and, consequently, less valuable.

The pine flatwoods/palmetto range community has been subject to a great deal of disturbance as the result of the harvesting of merchantable timber and grazing by livestock. Consequently, the loss of 583 acres of this community is not significant--especially, when compared to the 145,195 acres of palmetto in Hardee County.

Disruption of Wetlands. Although the loss of 605 acres of wetlands appears small when compared to the 78,200 acres of wetlands in Hardee County, the significance of this loss should be judged on the basis of their overall functional importance. From this perspective, the site wetlands were classified following guidelines established by the EPA (1978; 1979). Wetland areas on the property (see Figure 9-5) were classified as either Category 1, 2, or 3 as follows:

- Category 1 Wetlands are those wetlands on the site which occur within the 25-year floodplain of the Peace River or its tributaries upstream to the point of 5 cfs mean annual flow, or wetlands considered to be significant wildlife habitat.

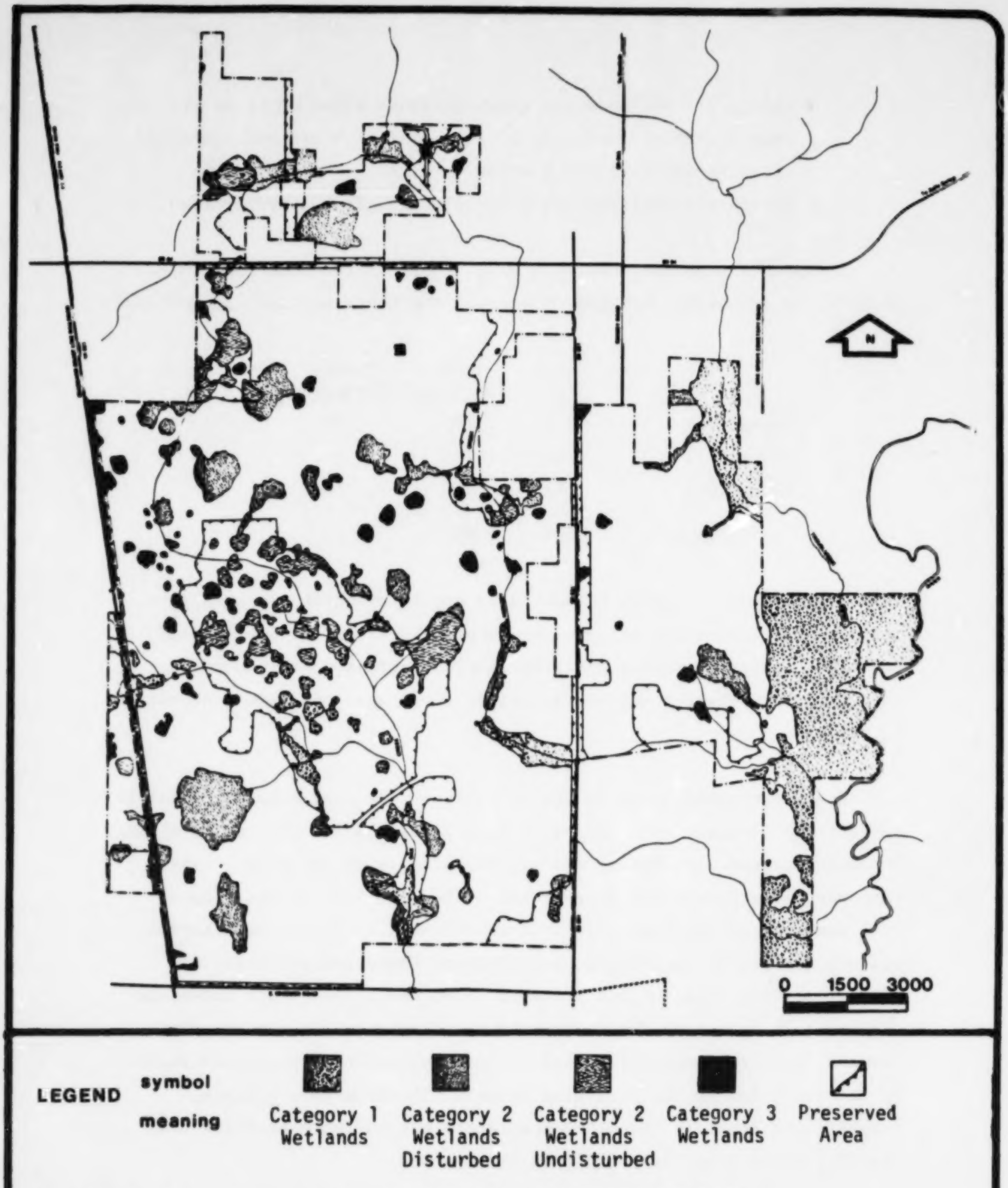

FIGURE 9-5. WETLAND CATEGORIZATION OF THE MINE SITE.

SOURCE: WOODWARD-CLYDE CONSULTANTS (1980)

- Category 2 Wetlands are those wetlands which occur in the 25-year floodplain upstream of the point of 5 cfs and isolated wetlands in excess of 5 acres in size.
- Category 3 Wetlands are isolated wetlands 5 acres or less.

Farmland's proposed mine plan will result in the loss and protection of the following acreages of each of the above wetland categories:

	Acres Lost	Acres Protected	Percent Protected
Category 1	0	710	100
Category 2	514	264	34
Category 3	91	18	16
TOTALS	605	992	62

Wetlands not directly disturbed by construction or mining activities may be indirectly affected by these activities. Effects could include temporary lowering of water levels, increased sedimentation, changes in groundwater and surface water flow, and long-term hydroperiod alterations.

The water table level in the vicinity of the open mine pits will be temporarily lowered for a period of 1 to 2 years while the ore is mined. Wetlands adjacent to these areas are expected to be affected by the temporary lowering of the water table. The magnitude of this impact will depend upon the rainfall level experienced at that time. Experiments conducted by the Central and Southern Flood Control District (Milleson 1976; Goodrick and Milleson 1974; Davis 1978) have shown that drawdowns of 2 to 4 months can result in substantial changes in plant biomass, species composition, and in the proportion of perennial plants in the marsh during the following season. The long-term effects, however, are likely to be minor and reversible as the vegetation continually adjusts to the prevailing hydroperiod.

Swamps along the lower portion of Hickory Creek may be affected by the temporary diversion of Upper Hickory Creek to Troublesome Creek for mining and the eventual impoundment of water to form a land and lakes system (see Section 2.6). The diversion will last for 4 years while the Upper Hickory Creek floodplain is mined and reclaimed with a lake system. This will deprive the hardwood overstory on the lower Hickory Creek floodplain of its usual water supply. In addition, the temporary dewatering of the Surficial Aquifer will further deprive the trees of their water supply. During this period the water supply for the trees will depend upon runoff collected in the creek channel.

Impacts on Faunal Populations. To understand the basis of anticipated impact on faunal populations of construction and operation of the mine, it is useful to distinguish between density independent effects and density dependent effects on the environment.

Factors that alter birth and death rates of a species population regardless of population density are called density independent. The operation of the mine, which will ultimately disturb nearly 5300 acres, will cause the death of smaller fauna (as well as the floral species) within the areas to be disturbed. Because these species populations are reduced regardless of their densities, this action is an example of a density independent effect.

A density dependent effect alters the birth rate or death rate as a function of the density of the population. Competition among members of the same population, or competition between one species population and members of other species are examples of density dependent effects. Density dependent factors change in effectiveness as the population size grows. Most such effects are negative (e.g., birth rates decrease and death rates accelerate (Wilson and Bossert 1971). For those species (primarily larger fauna such as deer, feral hog, and bobcat) likely to disperse from the site into surrounding undisturbed areas when clearing and grubbing commences, density dependent effects to both the displaced populations and those now occupying similar adjacent habitats (i.e., within the area immediately around the site) can be expected. The particular density dependent factor or combination of factors involved will vary, depending on which species population is affected. In one species, it may be mortality from predators; in another, shortage of food in certain seasons of the year. In some cases, movement of individuals to offsite areas may be largely successful if population levels in the offsite area are below carrying capacity. In general terms, carrying capacity is the limit to population growth of a particular species, imposed by environmental resistance under a given set of conditions (Boughey 1968).

Onsite, the impact of mine operation on local populations of certain species will be significant. Overall, the elimination of less mobile species (density independent effects), and the losses to species populations that move out of the site areas initially (density dependent effects) will represent an incremental loss. However, this loss alone will not be significant to terrestrial faunal populations in the region (i.e., areas within several miles of the site).

Fauna inhabiting the areas to be mined will be displaced or eliminated when these areas are cleared and grubbed. Mobile faunal species (e.g., most bird species, larger mammal species) are likely to move to undisturbed areas when clearing activities begin. More sedentary species (e.g., many reptile and amphibian species, smaller mammal species) will probably be eliminated because of an inability to successfully move from the disturbed areas. Fauna are expected to repopulate disturbed areas following reclamation. The species repopulating the reclaimed areas will depend largely on the type of habitat created.

Faunal species with the most restricted habitat requirements are those species that primarily inhabit wetlands (e.g., alligators, wading birds, marsh rabbit). Many of the species inhabiting the site's upland areas normally occur in all of the principal habitats on the site (e.g., white-tailed deer, feral hog, bobcat, raccoon, crow). In general, the loss of habitats resulting from the operation of the mine is expected to cause a decline in the onsite populations of most resident species. The regional effect of this loss is not expected to be significant because all of the affected habitats are common in the site region and only a small amount of the total available habitat will be lost (e.g., 10.3 percent of forestland and 0.8 percent of wetlands within Hardee County).

Of the 5280 acres that will be disrupted, 4395 acres (83 percent) is ruderal habitat. The loss of this ruderal habitat will not affect most species populations as severely as the loss of less disturbed habitats. The ruderal habitat results from the frequent disturbance and manipulation of vegetation (e.g., range management, pasture, citrus groves, cropland) primarily for agricultural purposes. As a consequence of this management, these areas generally do not support as diverse a fauna as is found in less disturbed habitats. Although the ruderal communities are an important habitat component for some of the site's faunal species such as the sandhill crane, cattle egret, and numerous invertebrates (e.g., herbivorous insects), the majority of the site's species basic habitat requirements are provided by the less disturbed natural plant communities.

Loss of the less disturbed upland forest (280 acres) and wetland (605 acres) habitats will affect a variety of fauna. The bayheads, hardwood swamps, and upland woodlands provide essential cover for many of the faunal species inhabiting the site. Approximately 38 percent of the site's wetlands and 35 percent of its upland forest will eventually be removed. Loss of these habitats should result in greater competition in similar adjacent undisturbed habitats and a resultant loss of individuals because of reduced nesting success, food availability, and/or cover.

Effects on Endangered or Threatened Species. Species observed on the Farmland site that have been classified as endangered or threatened by the U.S. Department of Interior (1980a) are listed below:

Species	Classification
Bald eagle	Endangered
American alligator	Threatened
Eastern indigo snake	Threatened

There are no known active bald eagle nests in Hardee County and the species occurs on the site only as a transient. Its occurrence on the site has been infrequent and its occurrences are expected to continue to be infrequent in the future. Consequently, operation of the proposed mine is not expected to have any noticeable effect on the bald eagle.

The American alligator is common on the site and is generally common throughout the western peninsular Florida region. The alligator is an inhabitant of river systems, canals, lakes, swamps, bayous, and coastal marshes. The Florida alligator population has increased substantially from the low levels of the late 1950s and early 1960s and is currently estimated to exceed 400,000. The proposed project will affect about 27 percent (320 acres) of the freshwater swamp habitat on the site. This disturbance will result in the dislocation of some alligators and possibly a decline in the overall alligator population on the site. The alligator is an adaptable species, and disturbed individuals are expected to readily move into adjacent undisturbed swamp habitat. The reclamation plan provides for the creation of 235 acres of lakes. This lake system should compensate for the loss of alligator habitat provided by the freshwater swamps and no long-term adverse effect on the alligator population in the site area is anticipated.

The eastern indigo snake appears to be a commonly occurring species on the site. The indigo snake occupies a variety of habitats throughout its range, from dry, sand pine-oak communities to moist tropical hammocks. The species is most suited to mesic environments, and its common occurrence in sand hills and other xeric habitats is possible only where gopher tortoise burrows or other subterranean cavities are available for shelter from the heat. In the Hardee County region it has been recorded most often from live oak hammocks, old fields, pine flatwoods, and oak-pine sand hills. Gopher tortoise burrows and other subterranean cavities are commonly used as dens for egg laying by the indigo snake, and the continuing decline of the gopher tortoise is probably having an adverse effect on indigo snake populations. The indigo snake population appears to be in a continuing decline because of habitat loss and illegal collection by snake fanciers or merchants.

The mining of the pine flatwoods/palmetto range and upland forest communities will eliminate some oak hammock and dry flatwood habitats and will thus reduce the onsite habitat available to the indigo snake. About 62 percent (583 acres) of the pine flatwoods/palmetto range and 35 percent (280 acres) of the upland forest communities on the site will be removed over the life of the mine. The habitats created as the result of restoration and reclamation programs are generally not suitable for the indigo snake (Layne, et al. 1977). Consequently, the long-term effect of the proposed project on the indigo snake will be a reduction in available upland habitat which may further reduce the species' population in the site region.

Hardee County is within the range of five other species that are also listed as endangered by the U.S. Department of Interior (1980a). These species are the red-cockaded woodpecker, Bachman's warbler, Kirtland's warbler, peregrene falcon, and Florida panther.

Bachman's warbler and Kirtland's warbler only occur in Florida as migrants and, consequently, would not be affected by the proposed project.

The red-cockaded woodpecker is resident in Hardee County. The red-cockaded woodpecker is generally an inhabitant of open pine woods and usually constructs its nesting cavity in mature pine trees. Due to past harvesting of pine trees, there are few mature pine trees on the proposed site. No red-cockaded woodpeckers were observed during field studies; and because of the absence of mature pines, it is highly unlikely that the species would be resident on the site.

The peregrine falcon only occurs in Florida as a wintering species. Florida's coastal areas are the principal wintering areas for the peregrine falcon. In the site area, the peregrine falcon can be expected to occur primarily as a migrant and, consequently should not be affected by the proposed project.

Sightings of panther are periodically reported from many parts of Florida. The swamp forests of the Peace River provide potential habitat for the panther, and it is possible that the species is present. Since mining will not be undertaken in the Peace River floodplain, the proposed project should have little effect on the potential panther habitat provided by the swamp forests of the Peace River.

Species observed on the site that have been classified as endangered, threatened, or of special concern by the Florida Game and Freshwater Fish Commission (1979) are listed below:

Species	Classification
Wood stork	Endangered
Bald eagle	Threatened
Florida sandhill crane	Threatened
Eastern indigo snake	Threatened
American alligator	Special Concern
Gopher tortoise	Special Concern
Florida burrowing owl	Special Concern
Little blue heron	Special Concern
Snowy egret	Special Concern
Louisiana heron	Special Concern

The wood stork is a commonly occurring species on the site. There is an active wood stork nesting colony located in Hardee County about 20 to 30 miles east of the site. The wood stork forages in freshwater and brackish wetlands and will travel as much as 60 miles to secure food for its young. Preferred feeding sites are freshwater marshes, flooded pastures, and ditches. The wood stork's survival is dependent upon vast expanses of wetlands capable of producing local concentrations of fish through established patterns of drying and flooding. Wetland drainage and manipulation of water levels are believed to be largely responsible for the decline in the Florida wood stork population. The mining operations will cause the eventual disturbance of about 73 percent (285 acres) of the freshwater marsh on the site. Nearly 340 acres of marsh will be restored through reclamation. Therefore, the long-term result will be an increase of almost 20 percent in freshwater marsh on the site. However, since no nesting colonies are located in the immediate site vicinity, the small increase in the amount of freshwater marsh habitat should have no direct effect on the wood stork population.

The Florida sandhill crane is a commonly occurring species on the site. The species is locally common in areas of suitable habitat in the western peninsular Florida region. The Florida sandhill crane prefers open habitats and is found primarily in wet and dry prairies, improved cattle pastures, and shallow marshes or lakes with sparse emergent vegetation surrounded by grasslands. The Florida sandhill crane is basically sedentary and is highly territorial during the breeding season, consequently, destruction of shallow marshes and ponds associated with the mining operations may be detrimental to the resident crane population. However, the creation of marsh habitat in reclamation would mitigate this impact.

The gopher tortoise is an uncommon species on the site. The gopher tortoise is an inhabitant of live oak hammocks, sand pine scrub, pine-turkey oak, and various successional types of xeric ruderal habitats.

Its principal habitat requirements include dry, well-drained sandy soils and good herbaceous cover on which to feed. Most of this habitat on the site has been converted to citrus groves, consequently, the mining operations are not expected to have a significant effect on the gopher tortoise population of the region.

The Florida burrowing owl is rare on the site. The burrowing owl is a resident of grasslands and dry prairies or any well-drained sandy ground with sparse growth. The mining operations should not have any effect on the burrowing owl population of the area because there is a large amount of potential habitat for this species available in the site area in the form of improved pasture. Over the long-term, potential habitat available for the burrowing owl may be increased as the result of creation of 3873 acres of improved habitat when reclamation has been completed.

The little blue heron, snowy egret, and Louisiana heron are all species of wading birds that are found in a variety of coastal and freshwater wetlands. Only the little blue heron commonly occurs on the site. As described previously in discussing the wood stork, there will be an approximate 20 percent increase in the freshwater marsh found on the site as a result of operation of the mine and reclamation activities. As was the case with the wood stork, any loss of habitat is likely to be detrimental to the populations of these wading birds. However, because no nesting colonies are located in the areas affected, and the loss of freshwater marsh habitat will only be temporary, there should be no direct effect on the populations of these wading birds.

Dredge Mining

The impacts associated with the destruction of terrestrial habitat described above for dragline mining would also be expected with dredge mining. The use of dredge mining would, however, reduce the indirect effects on wetland habitats that will occur as a result of dewatering of the Surficial Aquifer into open mine pits. Dredge mining would require that water levels be maintained in the active mining area, thus the surrounding Surficial Aquifer and water levels in nearby wetlands would be maintained.

Bucketwheel Mining

Bucketwheel mining would result in impacts on terrestrial ecology similar to those described for dragline mining.

9.2.2 WASTE SAND AND CLAY DISPOSAL

Sand-Clay Mixing (Farmland's Proposed Action)

The proposed action calls for the majority of the sand and clay wastes to be disposed of through the sand-clay mix technique (Figure 9-6). The sand-clay mix is expected to achieve a higher percent solids at a more rapid rate than clays along (25 percent solids rather than 17 percent solids clay basis) and provide more rapid recycling of a greater amount of water. This will provide for a more rapid achievement of a stable fill. Use of sand-clay mixing will minimize the extent of the land surface to be covered with slow drying, unstable phosphatic clays. Thus, the area to be available for Farmland's varied reclamation plan (see Section 2.6) will be maximized. The use of sand-clay mixing should also result in a land surface that closely approximates the original surface in both contour and elevation. However, it should be noted that large-scale sand-clay mixing has yet to be proven as a workable waste disposal technique in the phosphate industry. The success with which the proposed plan will work depends largely on what other operators achieve in the next 1 to 2 years.

Although Farmland proposes to dispose of most of the waste sand and clay through the sand-clay mix technique, separate sand and clay disposal areas will also be required. Waste clays will be impounded in diked areas covering 1078 acres during most of the life of the mine.

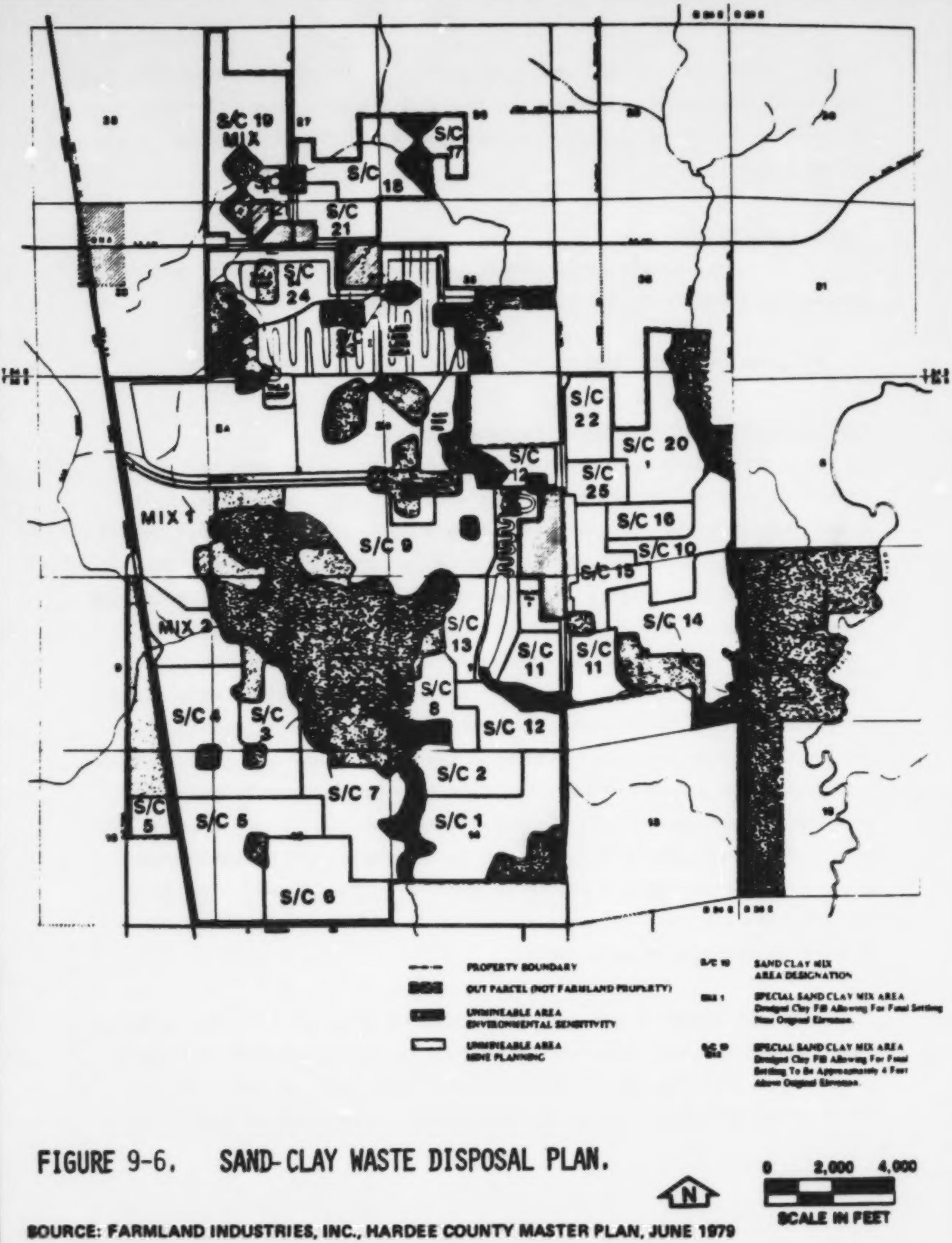
S/C 19 MIX
S/C 17
S/C 18
S/C 21
S/C 24
S/C 22
S/C 20
S/C 12
S/C 25
S/C 16
S/C 10
S/C 15
S/C 9
MIX 1
MIX 2
S/C 13
S/C 11
S/C 11
S/C 14
S/C 8
S/C 12
S/C 4
S/C 3
S/C 2
S/C 7
S/C 5
S/C 5
S/C 1
S/C 6
PROPERTY BOUNDARY
OUT PARCEL (NOT FARMLAND PROPERTY)
UNMINEABLE AREA ENVIRONMENTAL SENSITIVITY
UNMINEABLE AREA MINE PLANNING
S/C 10 SAND CLAY MIX AREA DESIGNATION
MIX 1 SPECIAL SAND CLAY MIX AREA Designed Clay Fill Allowing For Final Settling Near Original Elevation.
S/C 19 MIX SPECIAL SAND CLAY MIX AREA Designed Clay Fill Allowing For Final Settling To Be Approximately 4 Feet Above Original Elevation.
N
0
2,000
4,000
SCALE IN FEET

FIGURE 9-6. SAND-CLAY WASTE DISPOSAL PLAN.

SOURCE: FARMLAND INDUSTRIES, INC., HARDEE COUNTY MASTER PLAN, JUNE 1979

These large areas will contain clays at various densities, ranging from about 17 percent solids to less than 3 percent solids. Should a dike failure occur in an impoundment dike, this material could flow overland and into natural stream courses producing tremendous impacts on terrestrial biota. A worst-case analysis of the result of a dike failure in one of Farmland's proposed impoundments (Area I, the largest undivided settling area proposed) indicates that as much as 11,500 acre-feet of material could be released, most of which would find its way into Oak or Hickory Creeks (Farmland 1979a). Because the sand-clay mix should dewater and consolidate more rapidly than separately impounded clays, most of the wastes confined in the sand-clay mix disposal areas should not be in a fluid state. The area affected by a break in a sand-clay retention dike should, therefore, be relatively small.

Conventional Sand and Clay Disposal

This alternative involves disposal of clay slimes as conventionally practiced in the Florida phosphate industry. Clay slimes would be contained within diked areas both on virgin land and over mined-out areas. After the clay slimes had settled and compacted over a period of several years, these areas would generally be left to revegetate naturally or reclaimed as pasture. While conventional clay disposal would result in the creation of large areas of limited agricultural value, it has been shown that these areas could be beneficial to wildlife, particularly wetland species (The Wildlife Society 1978). However, the additional diking required to contain the separately impounded clay wastes would increase the probability of a dike failure over that which exists for sand-clay mix disposal.

9.2.3 PROCESS WATER SOURCES

Groundwater Withdrawal (Farmland's Proposed Action)

The major source of water for the proposed mine will be from onsite deep wells. The production wells will be drilled to an approximate depth of 1400 feet and cased to about 250 feet. Since the drawdown which results from this pumping must meet the requirements of the Southwest Florida Water Management District, the operation of these wells should have little impact on the surrounding terrestrial environments.

Surface Water Impoundment

Farmland's proposed rainfall collection facilities include only those structures which are a part of the mining, waste disposal, and water clarification and recirculation plans (amounting to a nominal average of 10.6 cfs of normal rainfall). In order to improve the collection of such water for use in the facility processes, additional catchment areas or reservoirs could be provided in the main drainage areas of the mine property (Figure 9-7). Such a reservoir system would probably best operate with the normal level at elevation 65 feet, allowing an additional 5 feet for emergency capacity for heavy rainfall periods. Such a reservoir system could also receive clarified excess water from the clay slimes storage area, should such release be necessary. The average flows of Hickory and Oak Creek would be maintained at 6.2 and 15.8 cfs, respectively, therefore the potential reservoir gain would come largely from above normal flows.

The impact associated with the construction of such a reservoir system would be significant because of the loss of the Oak Creek Islands area, which would be preserved under the proposed action. This area lies in the largest natural drainage through the site and thus would be the logical location for the surface water impoundment (see Figure 9-7).

9.2.4 RECLAMATION

Farmland's Proposed Reclamation Plan

Section 2.6 of this document provides a detailed description of Farmland's proposed reclamation plan. A brief discussion is provided in the following paragraphs.

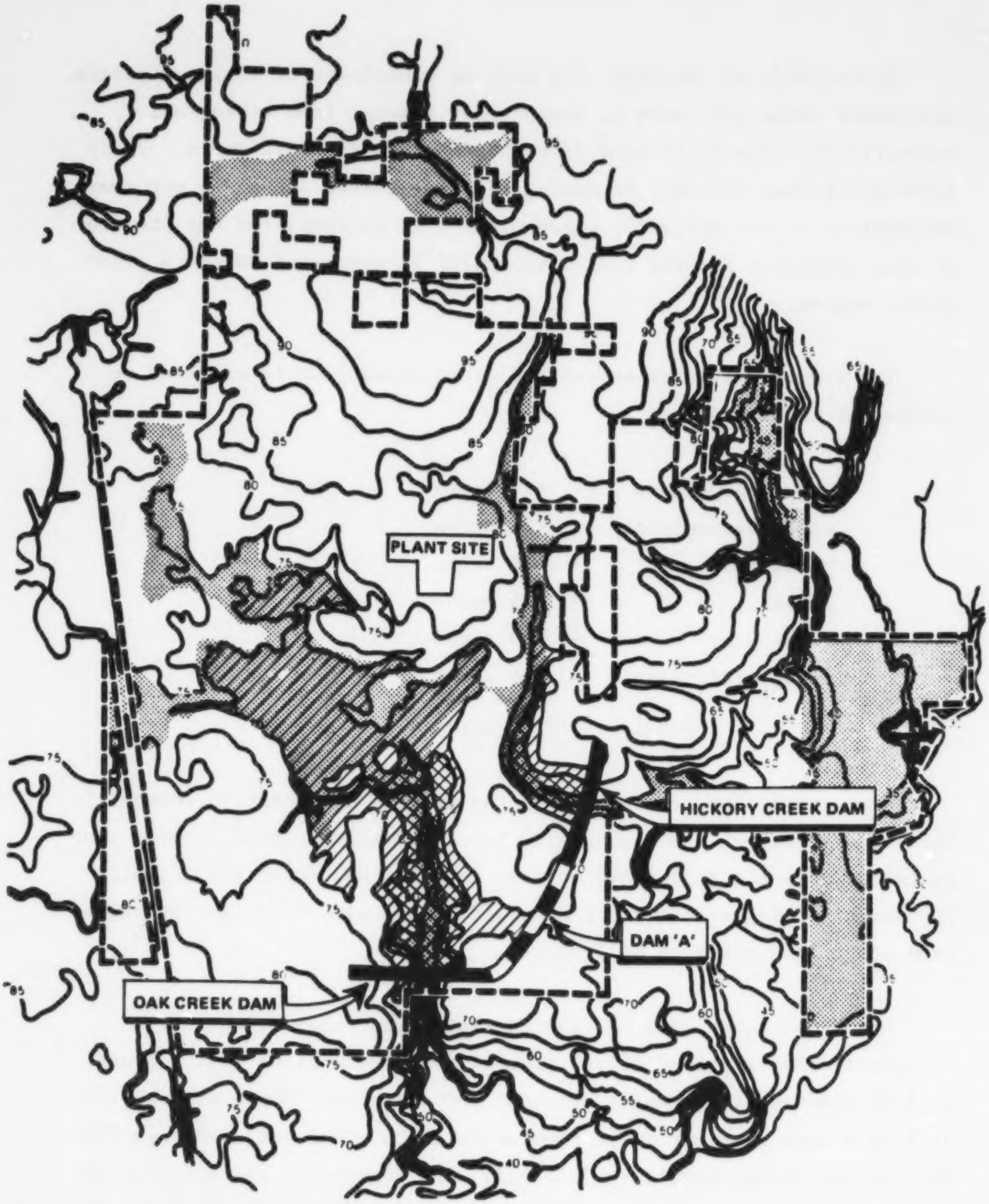

FIGURE 9-7. POTENTIAL WATER RETENTION RESERVOIR SITES ON THE MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979
BY J.J. CAPE

Reclamation of the mine site will be undertaken as mining proceeds, thus mined areas will only be temporarily removed from biological productivity. The total mine life is projected to be 20 years. It is anticipated that the rate of mining will not exceed 250 acres per year. Reclamation of the initially mined areas will be completed the 9th year of mine operation and all reclamation will be completed 30 years after mining begins.

The vegetative cover on the reclaimed mined land is expected to consist of the following:

Improved pasture	- 3873 acres
Other agriculture	- 224 acres
Mixed forest	- 550 acres
Lakes	- 235 acres
Freshwater marsh	- 339 acres
Freshwater swamp	- 59 acres
Total	5280 acres

Upon completion of reclamation the principal vegetative communities lost as a result of the mining will be citrus groves (1757 acres), pine flatwoods/palmetto range (583 acres), and wetlands (over 200 acres). The amount of improved pasture/cropland on the site will have increased from about 2569 acres to 4611 acres.

About 550 acres will be planted with mixed forest species to replace the 280 acres of upland forestlands that will be lost. Trees will be planted at a density of about 200 per acre. These will consist of 2 to 4 inch diameter trees from areas to be mined and seedlings from the Florida Forest Service. Initially, the vegetative characteristics of the mixed forest plantings will be that of a shrub or herbaceous community rather than a forest community. Assuming that no efforts are made to manipulate or control vegetative development on these planted areas, a mature mixed forest community should eventually develop on these areas as the result of natural vegetative succession.

Wetland Restoration. Farmland's proposed reclamation plan calls for the restoration of 398 acres of freshwater marsh/swamp on the mine site (see Section 8.2.4). Farmland's proposed mining plan will destroy a total of 514 acres of Category 2 wetlands on the site. Farmland (1979) indicates that up to 175 additional acres of wetlands could be created by differential grading and settling of sand-clay mix areas. If an additional 116 acres were added to that already planned, the total amount restored would be equal to the amount of Category 2 Wetlands destroyed by mining.

Natural Mine Cut Reclamation

Natural mine cut reclamation would greatly alter the potential use of the mined site. Because of the uneven terrain which would be left, the majority of the site would not be suited for agricultural use. The site would, however, be more suited for use by wildlife (once vegetation had reestablished itself) than will be the case under Farmland's proposed reclamation plan.

9.2.5 THE NO ACTION ALTERNATIVE

Under the no action alternative the terrestrial ecology of the Farmland site should continue to remain as described in Section 9.1. Most of the site would continue to be used for agricultural purposes. Presently, almost 55 percent (4333 acres) of the site has been drained and/or cleared for citrus groves, truck crops, or improved pasture. Another 153 acres consists of old fields, ditches, roads, rights-of-way, and artificial ponds. The uncleared portions of the site consist of about 1727 acres of pine flatwoods and other upland forest types and about 1597 acres of marshes and forested wetland and floodplain areas bordering the major stream courses. These uncleared areas are also used for cattle grazing. The U.S. Soil Conservation Service recommends that large ranches in Hardee County maintain two-thirds of their land in native range in order to balance improved pasture acreage. If these recommendations were followed in managing the site property, no additional clearing would be required.

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Table 9-1. ACREAGE OCCUPIED BY THE VARIOUS VEGETATION TYPES ON THE FARMLAND MINE SITE PROPERTY.

Type	FLUCCS Category[1]	Acres	Percentage
Citrus	230	1,917	25
Pasture	213	2,416	31
Early Successional[2]	262	153	2
Pine Flatwoods/Palmetto Range	411	937	12
Other Coniferous Upland Forest	414	62	1
Other Hardwood Upland Forest	422	417	5
Mixed Upland Forest	431	311	4
Freshwater Marsh	641	392	5
Freshwater Swamp	621	1,205	15

[1] The Florida Land Use and Cover Classification System (Florida Division of State Planning, 1976).

[2] Includes old fields, ditches, roads, rights-of-way, and artificial ponds.

Source: Farmland Industries, Inc. DRI June 1979.

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Importance Value[1]							
OVERSTORY LAYER								
Red Maple								
Acer rubrum					15	12	78	
Ironwood								
Carpinus caroliniana						10		
Water hickory								
Carya aquatica					3	13		
Pignut hickory								
Carya glabra					8	2	2	
Fringetree								
Chionanthus virginicus						1		
Citrus								
Citrus sp.					2	1	2	
Stiff-cornel dogwood								
Cornus stricta						1		
Hawthorn								
Crataegus marshallii						1		
Persimmon								
Diospyros virginiana				22	3	2		
Carolina ash								
Fraxinus caroliniana					1	18		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 2 of 30)

Common & Scientific Names	Classification and FLUCCS Category							
	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Importance Value[1]							
OVERSTORY LAYER, Continued								
Water locust								
Gleditsea aquatica						4		
Loblolly-bay								
Gordonia lasianthus							3	
Dahoon								
Ilex cassine					3		3	
Sweet gallberry								
Ilex coriacea				3				
Possumhaw								
Ilex decidua						1		
Myrtle-leaved holly								
Ilex myrtifolia				2		2		
Sweetgum								
Liquidambar styraciflua					35	52	36	
Sweetbay								
Magnolia virginiana					4	10	16	
Red mulberry								
Morus rubra					1	5		
Wax myrtle								
Myrica cerifera				15	11	1	2	
Water gum								
Nyssa aquatica						13		
Black gum								
Nyssa biflora						2		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 3 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Importance Value[1]							
OVERSTORY LAYER, Continued								
Silk bay								
Persea humilis				15				
Swamp bay								
Persea palustris					10		136	
Slash pine								
Pinus elliottii				3	2	1	3	
Longleaf Pine								
Pinus palustris				129				
Carolina laurel-cherry								
Prunus caroliniana						1		
Scrub-live oak								
Quercus geminata				5				
Laurel oak								
Quercus hemisphaerica							5	
Diamond-leaf oak								
Quercus laurifolia					17	44		
Myrtle oak								
Quercus myrtifolia				6				
Water oak								
Quercus nigra				3	24	16	2	
Live oak								
Quercus virginiana				92	108	16		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 4 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Importance Value[1]							
OVERSTORY LAYER, Continued								
Cabbage palm								
Sabal palmetto				5	51	48		
Carolina willow								
Salix caroliniana					1			
American snowbell								
Styrax americana						1		
Bald cypress								
Taxodium distichum						10		
American elm								
Ulmus americana					2	11	12	
Small-leaf viburnum								
Viburnum obovatum					1			
Species Number				12	20	28	13	
Total Basal Area/acre				9	185	223	104	
Total Stem Density/acre				109	530	651	499	

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 5 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[z]							
UNDERSTORY/SHRUB LAYER								
Red maple								
Acer rubrum					0	0	2	0
Groundsel-tree								
Baccharis glomeruliflora					0	0		
American beautyberry								
Callicarpa americana					0	0	2	
Trumpet creeper								
Campsus radicans						0		
Ironwood								
Carpinus caroliniana						2		0
Pignut hickory								
Carya glabra					0	0		
Buttonbush								
Cephalanthus occidentalis			1		0	0	2	0
Fringetree								
Chionanthus virginicus						0		
Citrus								
Citrus sp.					0	0		
Stiff-cornel dogwood								
Cornus stricta						0		
Hawthorn								
Crataegus marshallii					0	0		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 6 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[z]							
UNDERSTORY/SHRUB LAYER, Continued								
Persimmon								
Diospyros virginiana				2	2			
Carolina ash								
Fraxinus caroliniana					0	2		0
Dangleberry								
Gaylussacia frondosa							0	
Water locust								
Gleditsia aquatica						0		
Dahoon								
Ilex cassine					0	0	0	
Sweet gallberry								
Ilex coriacea						0	0	0
Possum haw								
Ilex decidua						0		
Gallberry								
Ilex glabra				2				
Myrtle-leaved holly								
Ilex myrtifolia			0			2		
Sweetspires								
Itea virginica			2			0	2	
Sweetgum								
Liquidambar styraciflua			0	0	2	2	0	

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 7 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
UNDERSTORY/SHRUB LAYER, Continued								
Southern magnolia *Magnolia grandiflora*						0		
Sweetbay *Magnolia virginiana*			2			1	2	0
Red mulberry *Morus rubra*					2	0		
Wax myrtle *Myrica cerifera*			2	2	2	2		0
Black gum *Nyssa biflora*					0	0		0
Redbay *Persea borbonia*					0			
Swamp bay *Persea palustris*			0				3	0
Longleaf pine *Pinus palustris*				0				
Carolina laurel-cherry *Prunus caroliniana*					0	0		
Scrub-live oak *Quercus geminata*				1	0			
Laurel oak *Quercus hemisphaerica*					1	0		
Diamond-leaf oak *Quercus laurifolia*			0		2	2		0

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 8 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
UNDERSTORY/SHRUB LAYER, Continued								
Myrtle oak								
Quercus myrtifolia			0	0	0			
Water oak								
Quercus nigra			0		0	0		
Live oak								
Quercus virginiana			0	0	2	0		
Winged sumac								
Rhus copallina			2	0	0			
Poison ivy								
Rhus radicans					0	2		
Blue-stem palmetto								
Sabal minor					3	3	0	
Cabbage palm								
Sabal palmetto			0		3	2		
Carolina willow								
Salix caroliniana			0					
Florida elderberry								
Sambucus simpsonii					0	0		0
Saw palmetto								
Serenoa repens				3	2	1		
Laurel-leaf greenbrier								
Smilax laurifolia			0				0	
Greenbriar								
Smilax sp.					0	0		
American snowbell								
Styrax americana					0	1		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 9 of 30)

Common & Scientific Names	Classification and FLUCCS Category							
	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
UNDERSTORY/SHRUB LAYER, Continued								
Bald cypress *Taxodium distichum*						0		
American elm *Ulmus americana*			2		0	2	2	0
Sparkleberry *Vaccinium arboreum*						0		
Possum-haw viburnum *Viburnum nudum*						0		
Blue haw *Viburnum rufidulum*					0			
Summer grape *Vitis aestivalis*						0		0
Muscadine grape *Vitis rotundifolia*			0		2	2	2	
Tallowwood *Ximenia americana*					0			
Species Number			17	10	34	42	14	13

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 10 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER								
Red Maple *Acer rubrum*					0	0	2	0
Gerardia *Agalinus linifolia*								0
Gerardia *Agalinus purpurea*								0
Peppervine *Ampelopsis arborea*				2	2	2		
Chalky bluestem *Andropogon cubanisii*			2	2				0
Broom-sedge *Andropogon virginicus*	2	2	3	0				
Broom-sedge *Andropogon virginicus* var. *glaucopsis*								0
Hercules club *Aralia spinosa*					0			
Jack-in-the-pulpit *Arisaema triphyllum*						0		
Wiregrass *Aristida stricta*				2				
Milkweed *Asclepias perennis*						0		
St. Peters-wort *Ascyrum stans*	0		2					
Dwarf paw paw *Asimena pygmaea*				0				

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 11 of 30)

Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Ebony spleenwort								
Asplenium platyneuron						0		
Bushy aster								
Aster dumosus								0
Aster								
Aster reticulatus			0					
Annual saltmarsh aster								
Aster subulatus								0
Aster								
Aster sp.			2					0
Southern lady fern								
Athyrium asplenoides						0		
Glade fern								
Athyrium pycnocarpon							0	
Groundsel tree								
Baccharis glomeruliflora		2	0			0		1
Water mint								
Bacopa caroliniana			0			0	0	2
Balduina								
Balduina angustifolia		0	0	0				
Beggar-tick								
Bidens laevis		3		0				
Beggar-tick								
Bidens mitis						1		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 12 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence^z							
GROUND COVER LAYER, Continued								
Spanish needles Bidens pilosa			1					2
Toothed mid-sorus fern Blechnum serrulatum						0	2	
False nettle Boehmeria cylindrica					0	2	2	
Blueheart Buchnera floridana								0
American beautyberry Callicarpa americana					2	0		
Trumpet creeper Campsus radicans						0		
Broad strapfern Campyloneuron phyllitidis							0	
Carex Carex alata						0		0
Carex Carex lupulina								0
Carphephorus Carphephorus corymbosus			2	0				
Ironwood Carpinus caroliniana						2		
Water hickory Carya aquatica						0		
Pignut hickory Carya glabra					0	0		
Partridge pea Cassia fasciculata	2	2	2	2				0

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 13 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Sandspur								
Cenchrus pauciflorus	0	0						
Coin wort								
Centella asiatica	2	0			0	2		0
Butterfly pea								
Centrosema virginianum			0					
Buttonbush								
Cephalanthus occidentalis		0	1			0	0	2
Alicia								
Chapmania floridana		2						
Pigweed								
Chenopodium album						0		
Citrus								
Citrus sp.						0		
Sawgrass								
Cladium jamaicensis							0	2
Dayflower								
Commelina diffusa								0
Dayflower								
Commelina elegans						0		
Dayflower								
Commelina sp.				0				
Tickseed								
Coreopsus leavenworthii	0		0					
Stiff-cornel dogwood								
Cornus stricta				0		0		
Hawthorn								
Crataegus marshallii				0	0			

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 14 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Southern swamp lily								
Crinum americanum				0	0	0	0	
Rattlebox								
Crotalaria angulata		0		0				
Rattlebox								
Crotalaria sagittalis	2	0	0					
Bermuda grass								
Cynodon dactylon	3	3						
Cyperus								
Cyperus alternifolius			2	0				
Redroot cyperus								
Cyperus erythrorhizos								0
Cyperus								
Cyperus esculentus	0	2		0		0		
Cyperus								
Cyperus haspan						0		1
Cyperus								
Cyperus iria						0		0
Cyperus								
Cyperus polystachyos	0	0	0					0
Beggar's lice								
Desmodium paniculatum				0		0		
Star-rush								
Dichromena colorata		0	0	0		0		
Crabgrass								
Digitaria adscendens	3							
Buttonweed								
Diodia virginiana						0		2

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 15 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[z]							
GROUND COVER LAYER, Continued								
Persimmon								
Diospyros virginiana			2	2	0	0		0
West Indian chickweed								
Drymaria cordata								0
Yerba-de-tago								
Eclipta alba								0
Water hyacinth								
Eichornia crassipes								0
Slender spikerush								
Eleocharis acicularis								3
Spikerush								
Eleocharis baldwinii		0		0				
Elephants-foot								
Elephantopus elatus	0		2	2				
Elephants-foot								
Elephantopus tomentosus						0		
Love grass								
Eragrostis hypnoides							1	
Love grass								
Eragrostis refracta							0	
Wooly beardgrass								
Erianthus giganteus		0					0	
Horse-weed								
Erigeron canadensis	2	2	2					
Daisy fleabane								
Erigeron vernus			0					
Rattlesnake master								
Eryngium yuccifolium			0	0		0		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 16 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence^2							
GROUND COVER LAYER, Continued								
Eupatorium *Eupatorium aromaticum*			2	2				
Dog fennel *Eupatorium capillifolium*	2	2	0	0				0
Mistflower *Eupatorium coelestinum*						0		
Thorough-wort *Eupatorium recurvens*				0				0
Spurge *Euphorbia maculata*		0						
Sedge *Fimbristylis puberula*		0	0	0		0		
Sedge *Fimbristylis schoenoides*								0
Swamp privet *Forestiera acuminata*						0		
Carolina ash *Fraxinus caroliniana*					2	2		0
Green ash *Fraxinus pennsylvatica*						0		
Milk pea *Galactia elliottii*	0	2	2	0	0	0		
Bedstraw *Galium obtusum*						0		0
Bedstraw *Galium tinctorium*								0
Dangleberry *Gaylussacia frondosa*							0	

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 17 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Yellow jassamine								
Gelsemium sempervirons				0	2	2		
Water locust								
Gleditsea aquatica						0		
Hedge hyssop								
Gratiola neglecta						0		
Sunflower								
Helianthus nashii				2				
Sunflower								
Helianthus sp.						0		
Rose mallow								
Hibiscus sp.		0						
Hawk weed								
Hieracium gronovii				0				
Pennywort								
Hydrocotyle umbellata	0		0			0		2
St.-Johns wort								
Hypericum drummondii				0				
St.-Johns wort								
Hypericum hypericoides						2		
St.-Johns wort								
Hypericum sp.	0							0

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 18 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Hyptis								
Hyptis alata					0			0
Yellow star grass								
Hypoxis hirsuta								
var. *leptocarpa*						0		
Yellow star grass								
Hypoxis juncea				0				
Dahoon								
Ilex cassine			0	0		0	0	
Sweet gallberry								
Ilex coriacea					0			
Possum haw								
Ilex decidua						0		
Gallberry								
Ilex glabra		2	2	2				
Myrtle-leaved holly								
Ilex myrtifolia			0			0		
Man-root								
Ipomoea pandurata			0					
Morning glory								
Ipomoea sp.						0		
Prairie iris								
Iris hexagona								
var. *savannarum*			0					2
Sweet-spires								
Itea virginica					0	2	0	0
Soft rush								
Juncus effusus			0					3

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 19 of 30)

Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Bog-buttons								
Lachnocaulon anceps		0						
Prickly lettuce								
Lactuca scariola					0			
Lantana								
Lantana camara		0						
Creeping bush clover								
Lespedeza repens				0				
Blazing-star								
Liatris chapmanii	0	0	2	2				
Lily								
Lilium sp.						0		
False pimpernel								
Lindernia grandiflora								1
Creeping charlie								
Lippia nodiflora	2							2
Sweetgum								
Liquidambar styraciflua				0	2	2		
Seedbox								
Ludwigia alternifolia		0		0			0	

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 20 of 30)

Common & Scientific Names	Classification and FLUCCS Category							
	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
False loosestrife								
Ludwigia arcuata			0					
False loosestrife								
Ludwigia decurrens							0	0
Marsh-purslane								
Ludwigia palustris						0		
Bugleweed								
Lycopus rubellus						0	0	
Fringed loosestrife								
Lysimachia lanceolatum				0				
Loosestrife								
Lythrum lanceolatum								0
Southern magnolia								
Magnolia grandiflora						0		
Sweet bay								
Magnolia virginiana						0	2	0
Climbing hempweed								
Mikania scandens					2	0		0
Partridge berry								
Mitchella repens					0	0		
Red mulberry								
Morus rubra						0		
Wax myrtle								
Myrica cerifera		0	2	2	0	0		0
Parrot feather								
Myriophyllum braziliense								0

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 21 of 30)

Common & Scientific Names	Classification and FLUCCS Category							
	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Boston fern								
Nephrolepsis exaltata							0	
Floating heart								
Nymphoides aquatica								0
Black gum								
Nyssa biflora							0	
Opismenus								
Opismenus regalis						0		
Cinnamon fern								
Osmunda cinnamomea					0	2		
Royal fern								
Osmunda regalis						0	2	0
Wood sorrel								
Oxalis corniculata					0	2		
Panicum								
Panicum anceps					0	0		0
Panicum								
Panicum ciliatum					0	2	0	0
Maidencane								
Panicum hemitomon			0					3

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 22 of 30)

Common & Scientific Names	Classification and FLUCCS Category Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Panicum *Panicum hians*						0		0
Panicum *Panicum polycaulon*	2	2	2	2	0			
Panicum *Panicum repens*	2			0				
Virginia creeper *Parthenocissus quinquefolia*		0			2	2	0	
Paspalum *Paspalum conjugatum*		0						
Water paspalum *Paspalum fluitans*							0	
Bahia grass *Paspalum notatum*	3	3		3				
Paspalum *Paspalum setaceum* var. *ciliatifolium*	4	2	2	2		0		0
Paspalum *Paspalum setaceum* var. *longepedunculatum*					2			
Passion flower *Passiflora incarnata*			0	0				0
Arrow arum *Peltandra virginica*							2	0
Silk bay *Persea humilis*				2				

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 23 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Swamp bay								
Persea palustris							0	
Phoebanthus								
Phoebanthus grandiforus			0					
Pokeweed								
Phytolacca americana		0		0				0
Stinking fleabane								
Pluchea foetida				0				0
Marsh fleabane								
Pluchea rosea								2
Yellow bachelor's button								
Polygala ragellii			0					
Swamp smartweed								
Polygonum hydropiperoides								2
Rotted smartweed								
Polygonum punctatum	0	1				0	0	3
Smartweed								
Polygonum setaceum						0		
Pickerelweed								
Pontederia cordata		0					0	2
Pickerelweed								
Pontederia lanceolata								0
Moss-rose								
Portulaca pilosa		0						

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 24 of 30)

Common & Scientific Names	Classification and FLUCCS Category Pasture 213	 Citrus Grove 230	 Old Field/ Early Successional 262	 Pine Flatwoods 411	 Mesic Hardwood Forest 422	 Mixed Hardwood Swamp 621	 Bayhead 621	 Fresh Marsh/ Wet Prairie 641
	Occurrence[z]							
GROUND COVER LAYER, Continued								
Carolina laurel-cherry								
Prunus caroliniana						0		
Wild coffee								
Psychotria sulzneri					2	2	0	
Bracken fern								
Pteridium aquilinum			0	0				
Rabbit tobacco								
Pterocaulon undulatum	2	0	2	2				
Scrub-live oak								
Quercus geminata				2				
Diamond-leaf oak								
Quercus laurifolia				0	0	2		
Myrtle oak								
Quercus myrtifolia				0	0			
Water oak								
Quercus nigra					2	2		
Willow oak								
Quercus phellos							0	
Live oak								
Quercus virginiana				0	2	0		
Oaks								
Quercus sp.			2					
Winged sumac								
Rhus copallina		0	2	2	2		0	
Poison ivy								
Rhus radicans				0	0	2	0	
Beakrush								
Rhynchospora caduca				0	0	0		0

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 25 of 30)

Common & Scientific Names	Classification and FLUCCS Category							
	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[z]							
GROUND COVER LAYER, Continued								
Beakrush Rhynchospora chapmanii			0					
Beakrush Rhynchospora microcarpa						0		
Beakrush Rhynchospora perplexa	2	2						
Yellow cress Rorippa sessiliflora			0					
Rose Rosa sp.			0					
Blackberry Rubus sp.						0		
Black-eyed susan Rudbeckia serotina		0	0					
Blue-stem palmetto Sabal minor					1	0		
Cabbage palm Sabal palmetto						2		
Arrowhead Sagittaria graminea								0
Arrowhead Sagittaria lancifolia							0	3
Carolina willow Salix caroliniana			2					
Lyre-leaved sage Salvia lyrata						0		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 26 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Southern elderberry								
Sambucus simpsonii						0		
Water pimpernel								
Samolus parviflora						0		
Lizard's tail								
Saururus cernuus						0	3	2
Bulrush								
Scirpus validus		2						
Saw-palmetto								
Serenoa repens		0	2	3	2	2		
Foxtail grass								
Setaria geniculata			0					0
Giant foxtail								
Setaria magna								0
Blue-eyed grass								
Sisyrinchium arenicola			0					
Blue-eyed grass								
Sisyrinchium atlanticum	0	0		0				0
Greenbrier								
Smilax bona-nox						2	0	
Laurel-leaf greenbrier								
Smilax laurifolia							2	
Greenbrier								
Smilax sp.			0		2			0
Soda-apple								
Solanum aculeatissimum						0		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 27 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Goldenrod								
Solidago fistulosa	2	0	2	0				0
Goldenrod								
Solidago graminea			2					
Goldenrod								
Solidago microcephala		2	1	0				0
Common sow-thistle								
Sonchus oleraceus		0	0					0
Sand cordgrass								
Spartina bakerii								1
Dropseed								
Sporobolus junceus			3	2				0
Smutgrass								
Sporobolus poiretti	2	2		0	0	0		
American snowbell								
Styrax americana					0	0	0	0
Wood sage								
Teurcrium canadense			2					
Widespread maiden fern								
Thelypteris normalis							0	
Marsh fern								
Thelypteris palustris						0	2	0
Spider wort								
Tradescantia roseolens				0				

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 28 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Purple top *Tridens flavus*						0		
Latino clover *Trifolium repens*	2			0				
Deers-tongue *Trilisa paniculata*				0				
Deers-tongue *Trilisa odoratissima*			0					
American elm *Ulmus americana*					0	0		
Caesar weed *Urena lobata*		0		0	2	2		
Bladderwort *Utricularia purpurea*								0
Elliott blueberry *Vaccinium elliottii*							0	
Evergreen blueberry *Vaccinium myrsinites*			2	0				
Small-leaf viburnum *Viburnum obovatum*						0		

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 29 of 30)

	Classification and FLUCCS Category							
Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Occurrence[2]							
GROUND COVER LAYER, Continued								
Summer grape								
Vitis aestivalis		0				0		
Muscadine grape								
Vitis rotundifolia				2	2	2	2	
Netuein chain fern								
Woodwardia areolata							2	
Yellow-eyed grass								
Xyris brevifolia				2				0
Species number	29	50	66	70	44	100	43	82
Total Plant Cover - Percent (Estimated)	87	78	58	59	15	27	34	83

Table 9-2. SPECIES COMPOSITION OF VEGETATION TYPES ON THE FARMLAND PROPERTY, Continued (Page 30 of 30)

Common & Scientific Names	Pasture 213	Citrus Grove 230	Old Field/ Early Successional 262	Pine Flatwoods 411	Mesic Hardwood Forest 422	Mixed Hardwood Swamp 621	Bayhead 621	Fresh Marsh/ Wet Prairie 641
	Classification and FLUCCS Category							
EPIPHYTES	Occurrence[3]							
Green-fly orchid Epidendron conopseum						R		
Butterfly orchid Epidendron tampense						R	R	
Golden rabbits foot fern Phebodium aureum						O		
Resurrection fern Polypodium polypoidioides						C	O	
Plumy rock-cap fern Polypodium plumula						R		
Wild pine Tillandsia fasciculata					O	O		
Wild pine Tillandsia polystachia					O	O	R	
Ball moss Tillendsia recurvata						R		
Needle-leaved wild pine Tillandsia setacea					C	A	O	
Spanish moss Tilandsia usneoides				O	A	C	O	
Shoestring fern Vittaria lineata						R		
Species Number				1	4	11	5	

[1] Numbers represent importance values based on relative density, relative dominance, and relative frequency.

[2] Numbers represent occurrence as follows:

0 - Frequency less than 25%, cover less than 5%.
1 - Frequency less than 25%, 5 to 10% cover.
2 - Frequency less than 25%, 10 to 25% cover.
3 - 25% to 50% frequency, 10 to 25% cover.
4 - Over 50% frequency, over 25% cover.

[3] A = Abundant; C = Common; O = Occasional; R = Rare.

Source: Farmland Industries, Inc. DRI June 1979.
Nomenclature: Radford, Ahles, and Bell 1968; Long and Lakela 1971.

Table 9-3. EXTENT OF WETLANDS CURRENTLY FOUND ON THE FARMLAND INDUSTRIES, INC. HARDEE COUNTY PHOSPHATE MINE SITE PROPERTY.

Type	FLUCCS Category[1]	Acres on Mine Site	Percentage of Mine-Site Acreage
Freshwater Marsh	641		
Sawgrass Type	a	127	1.6
Cattail-Bulrush-Maidencane Type	b	148	1.9
Wet Prairie Type	c	117	1.5
Freshwater Swamp	621		
Mixed Hardwood (overflow areas)	a	800	10.2
Bogs and Bayheads	b	341	4.4
Inland Ponds and Sloughs	c	64	0.8
Total Marsh		392	5.0
Total Swamp		1,205	15.4
Total Wetlands		1,597	20.4

[1] The Florida Land Use and Cover Classification System (Florida Division of State Planning 1976).

Source: Farmland Industries, Inc. DRI June 1979.

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
AMPHIBIANS													
Two-toed amphiuma Amphiuma means	RO		U	--	--	--	--	--	--	0	0	0	P
Greater siren Siren lacertina	LO		C	--	--	--	--	--	--	0	P	0	P
Dwarf siren Pseudobranchus striatus	RO		C	--	--	--	--	--	--	0	P	0	0
Newt Notophthalmus viridescens	LO		U	--	--	--	--	--	0	0	P	P	P
Dwarf salamander Eurycea quadridigitata	CO		U	--	--	--	--	--	--	P	0	P	P
Spadefoot Scaphiopus holbrooki	RO		U	--	--	--	0	0	0	P	0	--	P
Greenhouse frog Eleutherodactylus planirostris	RO		C	--	--	--	--	--	--	--	0	0	P
Southern toad Bufo terrestris	FO		C	--	--	--	--	P	P	P	P	--	P
Oak toad Bufo quercicus	FO		C	--	--	--	--	P	0	--	P	--	P
Southern cricket frog Acris gryllus	FO		C	--	--	--	--	--	--	0	P	0	P
Green treefrog Hyla cinerea	FO		C	--	--	--	--	--	--	0	0	P	P

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 2 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
AMPHIBIANS, Continued													
Barking treefrog													
Hyla gratiosa	RO		P	--	--	--	--	P	O	O	P	P	P
Pine woods treefrog													
Hyla femoralis	FO		C	--	--	--	--	P	O	O	P	P	P
Squirrel treefrog													
Hyla squirella	FO		A	P	--	--	--	P	P	O	P	P	P
Little grass frog													
Limnaoedus ocularis	FO		C	--	--	--	--	P	O	O	P	P	P
Chorus frog													
Pseudacris nigrita	RO		U	--	--	--	--	P	--	P	P	P	P
Eastern narrow-mouted toad													
Gastrophryne carolinensis	LO		C	--	--	--	--	P	P	P	P	P	P
Bullfrog													
Rana catesbeiana	FO		U	--	--	--	--	--	--	O	O	P	P
Pig frog													
Rana grylio	FO		C	--	--	--	--	--	--	O	P	P	P
Southern leopard frog													
Rana utricularia	FO		C	--	--	--	--	O	--	P	P	P	P
Florida gopher frog													
Rana areolata aesopus	RO		R	--	--	--	--	O	--	--	P	--	P

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 3 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
REPTILES													
American alligator *Alligator mississippiensis*	FO		C	--	--	--	--	--	--	P	P	P	P
Snapping turtle *Chelydra serpentina*	CO		C	--	--	--	--	--	--	--	P	O	P
Stinkpot *Sternotherus odoratus*	CO		C	--	--	--	--	--	--	O	P	P	P
Mud turtle *Kinosternon subrubrum*	FO		U	--	--	--	--	--	--	P	P	O	P
Striped mud turtle *Kinosternon bauri*	RO		C	--	--	--	--	--	--	P	O	O	P
Box turtle *Terrapene carolina*	FO		U	--	O	--	O	P	O	O	O	--	--
Peninsula cooter *Chrysemys floridana peninsularis*	FO		A	--	--	--	--	--	--	O	P	P	P
Florida red-bellied turtle *Chrysemys nelsoni*	FO		A	--	--	--	--	--	--	--	P	P	P
Chicken turtle *Deirochelys reticularia*	LO		C	--	--	--	--	--	--	O	P	P	P
Gopher tortoise *Gopherus polyphemus*	FO		U	--	--	--	--	O	O	--	--	--	--
Florida softshell *Trionyx ferox*	FO		C	--	--	--	--	--	--	--	P	P	P
Green anole *Anolis carolinensis*	FO		A	O	O	P	--	O	P	P	O	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 4 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
REPTILES, Continued													
Fence lizard Sceloporus undulatus	FO		U	--	--	--	--	O	O	--	--	--	--
Six-lined racerunner Cnemidophorus sexlineatus	FO		U	--	O	P	--	O	--	--	--	--	--
Ground skink Leiolopisma laterale	FO		A	--	P	P	--	O	P	P	--	--	--
Southeastern five-lined skink Eumeces inexpectatus	FO		C	--	O	O	--	O	O	P	--	--	--
Eastern glass lizard Ophisaurus ventralis	LO		U	--	O	O	O	P	P	P	P	--	--
Slender glass lizard Ophisaurus attenuatus	RO		R	--	P	O	P	O	O	--	--	--	--
Island glass lizard Ophisaurus compressus	RO		R	--	--	--	--	--	O	--	--	--	--
Worm lizard Rhineura floridana	RO		U	--	P	P	--	O	P	--	--	--	--
Green water snake Natrix cyclopion	RO		C	--	--	--	--	--	--	O	P	O	P
Brown water snake Natrix taxispilota	RO		C	--	--	--	--	--	--	O	--	P	O
Banded water snake Natrix fasciata	LO		A	--	--	--	--	--	--	O	P	P	P
Striped swamp snake Liodytes alleni	RO		C	--	--	--	--	--	--	O	P	O	P

Table 9-4. **TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 5 of 28)**

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
REPTILES, Continued													
Black swamp snake Seminatrix pygaea	RO		U	--	--	--	--	--	--	P	P	O	P
Brown snake Storeria dekayi	LO		R	--	--	--	--	O	--	O	O	--	O
Garter snake Thamnophis sirtalis	LO		C	--	--	P	--	O	O	O	P	O	O
Ribbon snake Thamnophis sauritus	CO		A	--	--	P	--	O	O	P	P	P	P
Eastern hognose snake Heterodon platyrhinos	RO		U	--	--	P	--	P	P	--	--	--	--
Southern hognose snake Heterodon simus	RO		R	O	--	--	O	O	--	--	--	--	--
Ringneck snake Diadophis punctatus	CO		C	--	--	O	--	O	O	O	P	O	--
Pine woods snake Rhadinaea flavilata	RO		R	--	--	--	--	P	--	O	--	--	--
Mud snake Farancia abacura	RO		U	--	--	--	--	--	--	P	P	O	O
Black racer Coluber constructor	FO		A	--	P	P	P	P	P	P	O	--	--
Coachwhip Masticophis flagellum	RO		R	--	O	O	O	P	P	--	--	--	--
Rough green snake Opheodrys aestivus	RO		U	--	--	O	--	P	P	P	--	--	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 6 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
REPTILES, Continued													
Eastern indigo snake													
Drymarchon corais couperi	FO		C	--	--	O	O	P	P	O	--	--	--
Corn snake													
Elaphe guttata	CO		U	O	O	O	--	O	O	O	--	--	--
Rat snake													
Elaphe obsoleta	LO		U	--	O	P	--	O	P	O	O	--	O
Pine snake													
Pituophis melanoleucus	RO		R	--	--	P	--	O	O	--	--	--	--
Kingsnake													
Lampropeltis getulus	CO		C	--	--	--	--	O	O	P	P	O	O
Scarlet kingsnake													
Lampropeltis triangulum	CO		R	--	--	O	--	O	P	P	--	--	--
Scarlet snake													
Cemophora coccinea	CO		R	--	--	--	--	P	P	--	--	--	--
Coral snake													
Micrurus fulvius	CO		U	--	--	O	--	O	P	O	--	--	--
Cottonmouth													
Agkistrodon piscivorus	FO		C	--	O	--	--	O	O	O	P	O	P
Pygmy rattlesnake													
Sistrurus miliarius	CO		U	--	O	--	--	P	P	P	P	--	O
Eastern diamondback rattlesnake													
Crotalus adamanteus	CO		C	--	O	O	P	P	O	--	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 7 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS													
Common loon													
Gavia immer	RO	W	U	--	--	--	--	--	--	--	--	--	O
Horned grebe													
Podiceps auritus	RO	W	U	--	--	--	--	--	--	--	--	--	O
Pied-billed grebe													
Podilymbus podiceps	CO	P	R	--	--	--	--	--	--	--	O	O	P
Double-crested cormorant													
Phalacrocorax auritus	FO	P	R	--	--	--	--	--	--	--	--	O	O
Anhinga													
Anhinga anhinga	FO	P	U	--	--	--	--	--	--	O	P	P	P
Great blue heron													
Ardea herodias	FO	P	C	--	O	--	O	--	--	O	P	--	--
Green heron													
Butorides striatus	FO	P	C	--	--	--	--	--	--	P	P	--	--
Little blue heron													
Florida caerulea	FO	P	C	--	--	--	--	--	--	O	P	--	--
Cattle egret													
Bubulcus ibis	FO	P	A	O	P	O	O	--	--	O	P	--	--
Great egret													
Casmerodius albus	FO	P	C	--	O	--	--	--	--	O	P	--	--
Snowy egret													
Egretta thula	FO	P	U	--	--	--	--	--	--	O	P	--	--
Louisiana heron													
Hydranassa tricolor	FO	P	U	--	--	--	--	--	--	O	P	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 8 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Black-crowned night heron *Nycticorax nycticorax*	LO	P	U	--	--	--	--	--	--	O	P	--	--
Yellow-crowned night heron *Nyctanassa violacea*	FO	P	U	--	--	--	--	--	--	O	O	--	--
Least bittern *Ixobrychus exilis*	LO	P	C	--	--	--	--	--	--	--	P	--	--
American bittern *Botaurus lentiginosus*	RO	W	U	--	--	--	--	--	--	--	P	--	--
Wood stork *Mycteria americana*	FO	P	C	--	O	--	--	--	--	O	P	--	--
Glossy ibis *Plegadis falcinellus*	RO	P	R	--	--	--	--	--	--	--	P	--	--
White ibis *Eudocimus albus*	FO	P	A	--	O	--	--	--	--	O	P	--	--
Mallard *Anas platyrhynchos*	RO	W	R	--	--	--	--	--	--	O	P	P	P
Black duck *Anas rubripes*	RO	W	R	--	--	--	--	--	--	--	--	O	O
Mottled duck *Anas fulvigula*	LO	P	U	--	--	--	--	O	O	O	P	O	O
Gadwall *Anas strepera*	RO	W	R	--	--	--	--	--	--	--	--	O	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 9 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Pintail *Anas acuta*	RO	W	U	--	--	--	--	--	--	--	P	O	P
Green-winged teal *Anas crecca*	RO	W	U	--	--	--	--	--	--	--	P	O	O
Blue-winged teal *Anas discors*	CO	W	U	--	--	--	--	--	--	--	O	O	O
American widgeon *Anas americana*	RO	W	U	--	--	--	--	--	--	--	P	O	O
Northern shoveler *Anas clypeata*	RO	W	U	--	--	--	--	--	--	--	--	O	O
Wood duck *Aix sponsa*	FO	P	C	--	--	--	--	--	O	P	O	O	O
Redhead *Aythya americana*	RO	W	R	--	--	--	--	--	--	--	--	P	P
Ring-necked duck *Aythya collaris*	RO	W	U	--	--	--	--	--	--	--	O	P	P
Canvasback *Aythya valisineria*	RO	W	R	--	--	--	--	--	--	--	O	O	O
Lesser scaup *Aythya affinis*	CO	W	C	--	--	--	--	--	--	--	--	O	P
Ruddy duck *Oxyura jamaicensis*	RO	W	R	--	--	--	--	--	--	--	--	O	O
Hooded merganser *Lophodytes cucullatus*	CO	W	C	--	--	--	--	--	--	O	O	O	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 10 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Red-breasted merganser *Mergus serrator*	RO	W	U	--	--	--	--	--	--	--	--	--	O
Turkey vulture *Cathartes aura*	FO	P	C	O	P	O	P	P	O	O	O	--	--
Black vulture *Coragyps atratus*	FO	P	A	--	P	O	P	O	O	O	P	--	--
Swallow-tailed kite *Elanoides forficatus*	FO	S	U	--	--	O	--	P	O	P	O	--	--
Sharp-shinned hawk *Accipiter striatus*	FO	W	U	--	--	P	O	P	P	P	--	--	--
Cooper's hawk *Accipiter cooperii*	RO	W	R	--	--	O	O	P	P	O	--	--	--
Red-tailed hawk *Buteo jamaicensis*	FO	P	U	--	O	P	P	P	O	O	O	--	--
Red-shouldered hawk *Buteo lineatus*	FO	P	C	--	O	O	O	O	P	P	O	--	--
Broad-winged hawk *Buteo platypterus*	RO	T	U	--	--	--	--	--	P	P	--	--	--
Swainson's hawk *Buteo swainsoni*	RO	T	U	--	O	--	O	O	--	--	--	--	--
Short-tailed hawk *Buteo brachyurus*	RO	P	U	--	--	--	--	O	P	P	--	--	--
Southern bald eagle *Haliaeetus l. leucocephalus*	FO	P	R	--	O	O	O	P	O	O	P	O	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 11 of 28)

				Habitat Types[4]									
Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Marsh hawk													
Circus cyaneus	FO	W	U	--	P	O	P	O	--	O	P	--	--
Osprey													
Pandion haliaetus carolinensis	FO	P	U	--	--	--	--	--	O	O	O	P	P
Audubon's caracara													
Caracara cheriway audubonii	CO	P	R	--	P	O	P	O	O	--	O	--	--
Merlin													
Falco columbarius	RO	T	R	--	O	--	O	O	--	--	O	--	--
American kestrel													
Falco sparverius sparverius	FO	W	C	O	P	P	P	O	O	--	O	--	--
Southeastern American kestrel													
Falco sparverius paulus	CO	P	R	O	P	P	P	O	O	--	O	--	--
Bobwhite													
Colinus virginianus	FO	P	A	--	P	P	P	P	O	O	O	--	--
Turkey													
Meleagris gallopavo	FO	P	U	--	O	O	P	P	P	P	O	--	--
Greater sandhill crane													
Grus canadensis tabida	CO	W	U	--	P	--	O	O	--	--	P	--	--
Florida sandhill crane													
Grus canadensis pratensis	FO	P	C	--	P	O	P	O	--	--	P	--	--
Limpkin													
Aramus guarauna	RO	P	U	--	--	--	--	--	--	P	P	P	O
King rail													
Rallus elegans	FO	P	U	--	O	--	--	--	--	O	P	--	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 12 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Virginia rail													
Rallus limicola	RO	W	R	--	--	--	--	--	--	O	P	--	--
Sora													
Porzana carolina	RO	W	C	--	--	--	--	--	--	O	P	--	--
Yellow rail													
Coturnicops noveboracensis	RO	T	U	--	--	--	--	--	--	--	P	--	--
Black rail													
Laterallus jamaicensis	RO	W	U	--	--	--	--	--	--	--	P	--	--
Purple gallinule													
Porphyrula martinica	RO	S	R	--	--	--	--	--	--	--	O	O	P
Common gallinule													
Gallinula chloropus	LO	P	U	--	--	--	--	--	--	--	O	P	P
American coot													
Fulica americana	FO	P	U	--	--	--	--	--	--	O	O	P	P
Killdeer													
Charadrius vociferus	FO	P	U	--	P	O	O	--	--	--	P	--	--
American woodcock													
Philohela minor	RO	W	R	--	O	--	--	--	O	P	O	--	--
Common snipe													
Capella gallinago	CO	W	C	--	O	--	O	O	--	O	P	--	--
Upland sandpiper													
Bartramia longicauda	RO	T	R	--	P	--	P	--	--	--	O	--	--
Spotted sandpiper													
Actitis macularia	CO	W	U	--	--	--	--	--	--	--	O	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 13 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Solitary sandpiper *Tringa solitaria*	RO	T	R	--	O	--	--	--	--	P	O	--	--
Greater yellowlegs *Tringa melanoleucus*	CO	W	U	--	O	--	--	--	--	--	P	O	O
Lesser yellowlegs *Tringa flavipes*	CO	W	U	--	O	--	--	--	--	--	P	--	--
Pectoral sandpiper *Calidris melanotos*	RO	T	U	--	--	--	--	--	--	--	P	--	--
Least sandpiper *Calidris minutilla*	RO	W	U	--	--	--	--	--	--	--	O	--	--
Long-billed dowitcher *Limnodromus scolopaceus*	FO	W	R	--	--	--	--	--	--	--	P	--	--
Black-necked stilt *Himantopus mexicanus*	RO	S	U	--	O	--	--	--	--	--	P	O	O
Herring gull *Larus argentatus*	RO	W	U	--	--	--	--	--	--	--	--	O	O
Ring-billed gull *Larus delawarensis*	RO	W	U	O	O	--	--	--	--	--	--	O	P
Laughing gull *Larus atricilla*	RO	P	U	O	--	--	--	--	--	--	--	O	O
Bonaparte's gull *Larus philadelphia*	RO	W	U	--	--	--	--	--	--	--	--	--	O
Gull-billed tern *Gelochelidon nilotica*	RO	S	U	O	O	--	O	--	--	--	O	O	O

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 14 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Forster's tern													
Sterna forsteri	RO	P	U	--	--	--	--	--	--	--	O	O	O
Least tern													
Sterna albifrons	CO	S	U	O	--	--	--	--	--	--	O	O	O
Royal tern													
Sterna maxima	RO	P	U	--	--	--	--	--	--	--	--	O	O
Caspian tern													
Sterna caspia	RO	P	U	--	--	--	--	--	--	--	O	O	O
Black tern													
Chlidonias niger	RO	T	U	--	--	--	--	--	--	--	O	O	O
Black skimmer													
Rynchops niger	RO	P	U	--	--	--	--	--	--	--	O	O	O
Rock dove													
Columba livia	FO	P	U	P	--	--	--	--	--	--	--	--	--
Mourning dove													
Zenaida macroura	FO	P	A	O	P	P	P	P	O	O	O	--	--
Ground dove													
Columbina passerina	FO	P	C	--	O	P	P	O	--	O	O	--	--
Yellow-billed cuckoo													
Coccyzus americanus	FO	S	C	--	--	O	--	--	P	P	--	--	--
Black-billed cuckoo													
Coccyzus erythropthalmus	RO	T	R	--	--	--	--	--	O	O	--	--	--
Barn owl													
Tyto alba	FO	P	U	O	O	P	O	O	O	O	O	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 15 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Screech owl													
Otus asio	CO	P	C	--	--	P	--	O	P	O	--	--	--
Great horned owl													
Bubo virginianus	RO	P	C	--	O	P	O	P	O	O	O	--	--
Florida burrowing owl													
Athene cunicularia floridana	CO	P	R	--	P	O	P	--	--	--	O	--	--
Barred owl													
Strix varia	FO	P	C	--	--	O	O	--	P	P	O	--	--
Short-eared owl													
Asio flammeus	RO	W	U	--	--	--	O	--	--	--	O	--	--
Chuck-will's-widow													
Caprimulgus carolinensis	FO	S	C	--	--	O	--	P	P	P	--	--	--
Whip-poor-will													
Caprimulgus vociferus	RO	W	R	--	--	--	--	O	P	O	--	--	--
Common nighthawk													
Chordeiles minor	FO	S	C	--	P	P	P	P	--	--	--	--	--
Chimney swift													
Chaetura pelagica	CO	S	U	--	O	O	--	--	--	--	O	--	--
Ruby-throated hummingbird													
Archilochus colubris	FO	S	U	--	--	O	--	--	O	O	--	--	--
Belted kingfisher													
Megaceryle alcyon	FO	W	C	--	O	--	--	--	--	O	P	P	P
Common flicker													
Colaptes auratus	FO	P	C	--	O	P	O	O	P	O	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 16 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Pileated woodpecker *Dryocopus pileatus*	FO	P	A	--	--	O	--	O	P	O	--	--	--
Red-bellied woodpecker *Melanerpes carolinus*	FO	P	A	--	--	P	O	P	P	O	--	--	--
Red-headed woodpecker *Melanerpes erythrocephalus*	FO	P	U	--	O	--	O	P	P	--	--	--	--
Yellow-bellied sapsucker *Sphyrapicus varius*	FO	W	C	--	--	P	--	P	P	P	--	--	--
Hairy woodpecker *Picoides villosus audubonii*	FO	P	U	--	--	O	--	O	P	O	--	--	--
Downy woodpecker *Picoides pubescens*	FO	P	C	--	--	O	--	O	P	P	--	--	--
Red-cockaded woodpecker *Picoides borealis*	CO	P	U	--	--	--	--	P	--	--	--	--	--
Eastern kingbird *Tyrannus tyrannus*	FO	S	U	--	O	P	--	P	--	--	--	--	--
Western kingbird *Tyrannus verticalis*	RO	T	U	--	--	--	O	O	--	--	--	--	--
Scissor-tailed flycatcher *Muscivora forficata*	RO	T	U	--	P	O	O	--	--	--	O	--	--
Great crested flycatcher *Myiarchus crinitus*	FO	S	U	--	O	P	--	P	--	--	--	--	--
Eastern phoebe *Sayornis phoebe*	FO	W	C	--	O	O	O	O	P	P	O	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 17 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Acadian flycatcher Empidonax virescens	RO	S	R	--	--	--	--	--	O	--	--	--	--
Eastern wood pewee Contopus virens	RO	T	U	--	--	O	--	P	P	O	--	--	--
Tree swallow Iridoprocne bicolor	CO	W	C	--	P	O	P	P	--	O	P	--	--
Bank swallow Riparia riparia	RO	T	U	--	P	--	O	--	--	--	P	--	--
Rough-winged swallow Stelgidopteryx ruficollis	RO	T	U	--	P	O	P	O	--	--	P	--	--
Barn swallow Hirundo rustica	RO	T	C	--	P	P	P	O	--	--	P	--	--
Cliff swallow Petrochelidon pyrrhonota	RO	T	U	--	P	--	--	--	--	--	--	--	--
Purple martin Progne subis	CO	S	U	--	P	P	O	O	--	O	P	--	--
Blue jay Cyanocitta cristata	FO	P	A	O	--	P	--	O	P	P	--	--	--
Common crow Corvus brachyrhynchos	FO	P	A	O	O	--	O	--	--	O	O	--	--
Fish crow Corvus ossifragus	LO	P	C	O	P	P	O	P	O	O	O	O	--
Carolina chickadee Parus carolinensis	CO	P	U	--	--	--	--	O	O	O	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 18 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Tufted titmouse													
Parus bicolor	FO	P	A	--	--	O	--	O	P	P	--	--	--
Brown-headed nuthatch													
Sitta pusilla	CO	P	R	--	--	--	--	P	--	--	--	--	--
House wren													
Troglodytes aedon	FO	W	C	--	--	P	P	P	O	P	--	--	--
Carolina wren													
Thryothorus ludovicianus	FO	P	A	--	--	O	O	O	P	P	--	--	--
Long-billed marsh wren													
Cistothorus palustris	LO	W	U	--	--	--	--	--	--	--	P	--	--
Short-billed marsh wren													
Cistothorus platensis	RO	W	U	--	O	--	O	--	--	O	P	--	--
Mockingbird													
Mimus polyglottos	FO	P	C	P	O	P	O	O	O	O	--	--	--
Gray catbird													
Dumetella carolinensis	FO	W	C	--	O	O	O	O	P	P	--	--	--
Brown thrasher													
Toxostoma rufum	FO	P	C	--	P	O	--	O	P	O	--	--	--
American robin													
Turdus migratorius	LO	W	C	--	P	O	O	O	P	P	--	--	--
Wood thrush													
Hylocichla mustelina	RO	T	U	--	--	--	--	--	P	P	--	--	--
Hermit thrush													
Catharus guttata	FO	W	U	--	--	--	--	--	P	P	--	--	--

Table 9-4. **TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY** Continued (Page 19 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Swainson's thrush													
Catharus ustulata	RO	T	R	--	--	O	--	--	O	O	--	--	--
Veery													
Catharus fuscescens	RO	T	U	--	--	--	--	--	P	O	--	--	--
Eastern bluebird													
Sialia sialis	FO	P	U	--	P	O	O	P	--	--	--	--	--
Blue-gray gnatcatcher													
Polioptila caerulea	FO	P	C	--	--	--	O	O	O	P	P	--	--
Ruby-crowned kinglet													
Regulus calendula	RO	W	C	--	--	O	--	--	P	P	--	--	--
Water pipit													
Anthus spinoletta	RO	W	U	--	P	--	--	--	--	--	P	--	--
Cedar waxwing													
Bombycilla cedrorum	RO	W	U	--	--	--	--	--	O	P	--	--	--
Loggerhead shrike													
Lanius ludovicianus	FO	P	C	--	O	P	P	O	O	O	O	--	--
Starling													
Sturnus vulgaris	CO	P	R	O	O	P	O	--	--	--	--	--	--
White-eyed vireo													
Vireo griseus	FO	P	A	--	--	O	O	O	P	P	--	--	--
Yellow-throated vireo													
Vireo flavifrons	CO	T	U	--	--	--	--	--	P	O	--	--	--
Solitary vireo													
Vireo solitarius	RO	W	C	--	--	O	--	O	P	P	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 20 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Red-eyed vireo													
Vireo olivaceus	FO	S	U	--	--	--	--	--	P	O	--	--	--
Black-and-white warbler													
Mniotilta varia	FO	W	C	--	--	--	--	--	P	O	--	--	--
Prothonotary warbler													
Protonotaria citrea	RO	T	U	--	--	--	--	--	O	P	--	--	--
Tennessee warbler													
Vermivora peregrina	RO	T	U	--	--	--	--	--	P	O	--	--	--
Orange-crowned warbler													
Vermivora celata	RO	W	U	--	--	--	--	--	P	P	--	--	--
Northern parula													
Parula americana	FO	S	C	--	--	--	--	O	P	P	--	--	--
Yellow warbler													
Dendroica petechia	RO	T	U	--	--	--	--	--	O	P	--	--	--
Magnolia warbler													
Dendroica magnolia	RO	T	U	--	--	--	--	--	P	P	--	--	--
Cape May warbler													
Dendroica tigrina	RO	T	U	--	--	--	--	--	P	O	--	--	--
Black-throated blue warbler													
Dendroica caerulescens	RO	T	U	--	--	--	--	--	P	P	--	--	--
Yellow-rumped warbler													
Dendroica coronata	LO	W	A	--	O	O	P	P	P	P	O	--	--
Black-throated green warbler													
Dendroica virens	RO	T	R	--	--	--	--	--	P	O	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 21 of 28)

				Habitat Types[4]									
Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Blackburnian warbler Dendroica fusca	RO	T	U	--	--	--	--	--	P	P	--	--	--
Yellow-throated warbler Dendroica dominica	FO	P	C	--	--	--	--	O	P	P	--	--	--
Blackpoll warbler Dendroica striata	RO	T	C	--	--	--	--	--	P	O	--	--	--
Pine warbler Dendroica pinus	CO	P	U	--	--	--	--	P	O	--	--	--	--
Prairie warbler Dendroica discolor discolor	RO	W	U	--	--	--	O	O	P	O	--	--	--
Palm warbler Dendroica palmarum	LO	W	C	--	P	O	P	P	P	O	O	--	--
Ovenbird Seiurus aurocapillus	FO	T	C	--	--	--	--	O	P	P	--	--	--
Northern waterthrush Seiurus noveboracensis	RO	T	U	--	--	--	--	--	O	P	--	--	--
Louisiana waterthrush Seiurus motacilla	RO	T	U	--	--	--	--	--	--	P	--	--	--
Common yellowthroat Geothlypis trichas	FO	P	C	--	P	O	O	P	O	P	P	--	--
Hooded warbler Wilsonia citrina	RO	T	R	--	--	--	--	--	P	P	--	--	--
American redstart Setophaga ruticilla ruticilla	RO	T	C	--	--	--	O	O	P	O	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 22 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
House sparrow Passer domesticus	CO	P	U	P	P	P	--	--	--	--	--	--	--
Bobolink Dolichonyx oryzivorus	RO	T	U	--	P	--	P	--	--	--	P	--	--
Eastern meadowlark Sturnella magna	FO	P	C	--	P	--	P	O	--	--	O	--	--
Red-winged blackbird Agelaius phoeniceus	FO	P	U	--	P	O	O	O	O	O	P	--	--
Orchard oriole Icterus spurius	RO	T	R	--	--	O	--	--	O	--	--	--	--
Northern oriole Icterus galbula	RO	T	R	--	--	O	--	--	O	--	--	--	--
Rusty blackbird Euphagus carolina	CO	W	R	--	--	--	--	--	--	P	O	--	--
Boat-tailed grackle Quiscalus major	LO	P	U	--	O	O	O	--	--	P	P	--	--
Common grackle Quiscalus quiscula	FO	P	C	--	O	P	--	--	P	O	--	--	--
Brown-headed cowbird Molothrus ater	RO	W	U	--	P	P	O	--	--	--	O	--	--
Scarlet tanager Piranga olivacea	RO	T	R	--	--	--	--	--	O	O	--	--	--
Summer tanager Piranga rubra	CO	S	U	--	--	--	--	O	P	P	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 23 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Cardinal													
Cardinalis cardinalis	FO	P	C	O	--	O	O	O	P	P	--	--	--
Rose-breasted grosbeak													
Pheucticus ludovicianus	RO	T	R	--	--	--	--	--	P	P	--	--	--
Blue grosbeak													
Guiraca caeurulea	RO	T	R	--	--	--	O	--	--	O	--	--	--
Indigo bunting													
Passerina cyanea	RO	T	R[5]	--	--	--	P	--	O	P	--	--	--
Painted bunting													
Passerina ciris	RO	T	U	--	O	--	O	--	O	--	--	--	--
Dickcissel													
Spiza americana	CO	W	U	--	O	O	O	--	--	--	--	--	--
American goldfinch													
Carduelis tristis	CO	W	C	--	P	P	P	O	P	O	O	--	--
Rufous-sided towhee													
Pipilo erythrophthalmus	FO	P	A	--	O	O	P	P	P	O	O	--	--
Savannah sparrow													
Passerculus sandwichensis	CO	W	C	--	P	O	P	O	--	O	O	--	--
Grasshopper sparrow													
Ammondramus savannarum	RO	W	R	--	P	O	P	O	--	--	--	--	--
Leconte's sparrow													
Ammospiza leconteii	RO	W	U	--	O	--	--	--	--	--	O	--	--
Vesper sparrow													
Pooecetes gramineus	RO	W	U	--	P	O	P	--	--	--	O	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 24 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
BIRDS, Continued													
Bachman's sparrow													
Aimophila aestivalis	CO	P	U	--	O	--	O	P	--	--	--	--	--
Chipping sparrow													
Spizella passerina	RO	W	C	--	P	P	O	O	O	--	--	--	--
Field sparrow													
Spizella pusilla	RO	W	U	--	P	P	P	--	--	--	--	--	--
White-crowned sparrow													
Zonotrichia leucophyrys	RO	W	U	--	P	--	P	--	--	--	--	--	--
White-throated sparrow													
Zonotrichia albicollis	RO	W	U	--	--	O	P	--	--	O	--	--	--
Lincoln's sparrow													
Melospiza lincolnii	RO	T	U	--	--	--	O	--	O	O	--	--	--
Swamp sparrow													
Melospiza georgiana	CO	W	C	--	O	--	O	O	--	P	P	--	--
Song sparrow													
Melospiza melodia	CO	W	U	--	O	--	O	--	--	O	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 25 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
MAMMALS													
Virginia opossum Didelphis virginiana	FO		C	O	O	P	O	P	P	P	O	--	--
Short-tailed shrew Blarina brevicauda	CO		R	--	O	--	--	O	--	P	O	--	--
Least shrew Cryptotis parva	RO		C	--	P	--	P	P	--	O	--	--	--
Eastern mole Scalopus aquaticus	FO		C	P	P	P	P	P	P	--	--	--	--
Eastern pipistrelle Pipistrellus subflavus	RO		I	--	--	--	--	--	O	--	--	--	--
Big brown bat Eptesicus fuscus	RO		I	O	O	--	O	--	--	--	--	--	O
Red bat Lasiurus borealis	CO		I	--	O	O	--	--	O	--	--	O	O
Seminole bat Lasiurus seminolus	CO		I	O	--	O	O	--	O	--	--	O	O
Northern yellow bat Lasiurus intermedius	CO		C	--	P	O	--	O	P	O	--	--	O
Evening bat Nycticeius humeralis	RO		C	O	--	P	--	P	P	P	--	--	--
Rafinesque's big-eared bat Plecotus rafinesquii	RO		U	--	--	--	--	--	P	--	--	--	--
Brazilian free-tailed bat Tadarida brasiliensis	RO		C	P	--	--	--	--	--	--	--	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 26 of 28)

				Habitat Types[4]									
Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	100	213	230	262	411	422	621	641	511	561
MAMMALS, Continued													
Nine-banded armadillo *Dasypus novemeinetus*	FO		A	O	P	P	P	P	P	P	O	--	--
Marsh rabbit *Sylvilagus palustris*	CO		U	--	O	--	--	O	O	P	P	--	--
Eastern cottontail *Sylvilagus floridanus*	FO		C	P	P	P	P	P	O	O	O	--	--
Gray squirrel *Sciurus carolinensis*	FO		A	--	--	--	--	O	P	P	--	--	--
Sherman's fox squirrel *Sciurus niger shermani*	FO		U	--	--	P	O	P	O	--	--	--	--
Southern flying squirrel *Glaucomys volans*	RO		C	--	--	--	--	O	P	P	--	--	--
Southeastern pocket gopher *Geomys pinetis*	LO		U	--	P	P	P	P	O	--	--	--	--
Marsh rice rat *Oryzomys palustris*	CO		C	--	P	--	--	O	P	P	--	--	P
Eastern harvest mouse *Reithrodontomys humulis*	RO		U	--	P	--	P	P	--	--	P	--	--
Cotton mouse *Peromyscus gossypinus*	CO		C	--	--	P	O	O	P	P	O	--	--
Golden mouse *Ochrotomys nuttalli*	RO		U	--	--	--	--	--	--	P	--	--	--
Hispid cotton rat *Sigmodon hispidus*	CO		C	--	P	O	P	P	O	P	P	--	--

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Continued (Page 27 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
MAMMALS, Continued													
Eastern woodrat													
Neotoma floridana	CO		U	--	--	--	--	--	P	P	--	--	--
Round-tailed muskrat													
Neofiber alleni	RO		U	--	--	--	--	--	--	--	P	--	P
Black rat													
Rattus rattus	CO		C	P	P	--	--	P	O	O	--	--	--
House mouse													
Mus musculus	CO		C	P	P	--	--	O	--	--	O	--	--
Red fox													
Vulpes vulpes	CO		U	O	P	P	O	--	--	P	--	--	--
Gray fox													
Urocyon cinereoargenteus	FO		U	O	O	O	O	P	P	--	--	--	--
Florida black bear													
Ursus americanus floridanus	RO		U	--	O	O	O	O	--	P	--	--	--
Raccoon													
Procyon lotor	FO		C	P	P	P	O	P	P	P	P	P	P
Florida long-tailed weasel													
Mustela frenata peninsulae	CO		U	--	O	O	--	O	O	O	O	--	--
Eastern spotted skunk													
Spilogale putorius	RO		U	--	O	--	P	O	O	--	--	--	--
Striped skunk													
Mephitis mephitis	CO		U	O	O	O	O	P	O	O	--	--	--
River otter													
Lutra canadensis	FO		U	--	--	--	--	--	--	O	O	P	P

Table 9-4. TERRESTRIAL ANIMAL SPECIES KNOWN OR EXPECTED TO OCCUR IN VARIOUS HABITATS ON THE FARMLAND PROPERTY Concluded (Page 28 of 28)

Common & Scientific Names	Occurrence[1]	Season[2]	Abundance[3]	Habitat Types[4]									
				100	213	230	262	411	422	621	641	511	561
MAMMALS, Continued													
Florida panther Felis concolor coryi	RO		U	--	O	O	--	O	O	O	O	O	--
Bobcat Felis rufus	LO		C	--	O	O	P	P	P	P	O	--	--
Wild hog Sus scrofa	FO		C	--	P	--	P	P	P	P	P	--	--
White-tailed deer Odocoileus virginianus	FO		C	--	P	O	P	P	P	O	P	--	--

[1] Occurrence:
FO = Onsite occurrence (sighting on Farmland property or adjoining lands within 1/2 mile).
LO = Local occurrence (sighting within 10 miles of Farmland property, excluding onsite lands).
CO = County occurrence (verified occurrence in county but not sighted onsite or locally).
RO = Regional occurrence (expected in county but no verified record).

[2] Seasonality (birds only):
P = Permanent; W = Winter Resident; S = Summer Resident; T = Transient.

[3] Abundance:
A = Abundant; C = Common; U = Uncommon; R = Rare; I = Insufficient Information.

[4] Habitat Types:
100 = Urban
213 = Pasture
230 = Citrus
262 = Old Field/Early Successional
411 = Pine Flatwoods
422 = Mesic Hardwood Forest
621 = Hardwood Swamp/Bayhead
641 = Fresh Marsh/Wet Prairie
511 = Rivers, Creeks
561 = Lakes, Ponds.

P = Preferred Habitat; O = Other Habitat Utilized; -- = Habitat Not Utilized.

[5] Source: DRI Mississippi Chemical, 197_.

Source: Farmland Industries, Inc. DRI, June 1979.
Nomenclature: Conant 1975; Burt & Grossenheider 1964; 32nd Supplement to American Ornithological Union Checklist 1973.

Table 9-5. STATUS AND LIKELIHOOD OF OCCURRENCE ON THE FARMLAND INDUSTRIES HARDEE COUNTY SITE OF PLANT SPECIES LISTED BY THE FLORIDA COMMITTEE ON RARE AND ENDANGERED PLANTS AND ANIMALS (1976) AS ENDANGERED, THREATENED, OR RARE.

Species	Status	Likelihood of Occurrence*	Habitat	Possible Onsite Habitat	Reported Range Includes Hardee County
Spurred neottia *Centrogenium setaceum*	Endangered	Very low	Low hammocks	Peace River Forest	No
Pygmy fringe-tree *Chionanthus pygamaeus*	Endangered	Very low	White sand scrub	Habitat Converted to citrus	No
Highland scrub hypericum *Hypericum cumulicola*	Endangered	Very low	Scrub, xeric hammock	None Specific	No
Hand fern *Ophioglossum*	Endangered	Low	Cabbage palm hammocks	Oak Creek & Peace River Forests	No
Lewton's polygala *Polygala lentonii*	Endangered	Very low	White sand scrub	Habitat Converted to citrus	No
Scrub plum *Prunus geniculata*	Endangered	Very low	White sand scrub	Habitat Converted to citrus	No
Curtis milkweed *Asclepias curtissii*	Threatened	Low	Scrub, xeric hammock	Habitat Converted to citrus	Yes
Florida bonamia *Bonamia grandiflora*	Threatened	Very low	White sand scrub	Habitat Converted to citrus	Yes
Scrub buckwheat *Erigonum floridana*	Threatened	Very low	Scrub sandhills	Habitat Converted to citrus	Yes
Needle palm *Rhapidophyllum hystrix*	Threatened	Moderate	Springfed stream bottoms, wooded ravines	Oak Creek & Peace River Forests	Yes

Table 9-5. STATUS AND LIKELIHOOD OF OCCURRENCE ON THE FARMLAND INDUSTRIES HARDEE COUNTY SITE OF PLANT SPECIES LISTED BY THE FLORIDA COMMITTEE ON RARE AND ENDANGERED PLANTS AND ANIMALS (1976) AS ENDANGERED, THREATENED, OR RARE, Concluded (Page 2 of 2)

Species	Status	Likelihood of Occurrence*	Habitat	Possible Onsite Habitat	Reported Range Includes Hardee County
Twisted air plant Tillandsia flexuosa	Threatened	Low	Drier hammocks	Oak Creek Islands	No
Coontie Zamia integrifolia	Threatened	Moderate	Mesic & hydric hammocks	Oak Creek and Peace River Forests	Yes
Venus'-hair fern Adiantum capillus-veneris	Rare	Very low	Calcareous hardwoods	Peace River Forest	No
Water sundew Drosera intermedia	Rare	Low	Clear streams & ponds	Oak Creek Basin	Yes
Hartwrightia Hartwrightia floridana	Rare	Moderate	Marshes & low flatwoods	Oak Creek Basin	Yes
Spoon-flowers Peltandra sagittifolia	Rare	Moderate	Wet hammocks, bays, rivers	Peace River & Oak Creek Basin	Yes

*Determined by Environmental Science and Engineering, Inc.

Source: Farmland Industries, Inc. DRI, June 1979.

Table 9-6. ENDANGERED, THREATENED, RARE, AND SPECIAL CONCERN SPECIES WHOSE RANGES INCLUDE HARDEE COUNTY.[1]

Common & Scientific Names	Status F	Status S	Status NG[2]	Comments
AMPHIBIANS				
Florida gopher frog				
Rana areolata aesopus	-	-	T	Sandhills and sand pine scrub are preferred habitat, but utilizes gopher tortoise burrows and breeds in shallow ponds.
REPTILES				
Gopher tortoise				
Gopherus polyphemus	-	S	T	Occupies dry sandy soils; found in Oak Creek Islands.
American alligator				
Alligator mississippiensis	T*	S	S	Hickory Creek and Peace River.
Eastern indigo snake				
Drymarchon corais couperi	T*	T	S	Varied habitat, utilizes gopher tortoies burrows in drier habitats.
BIRDS				
Wood stork				
Mycteria americana	-	E	E	Wetlands, Peace River Swamp.
Red-cockaded woodpecker				
Picoides borealis	E*	T	E	Restricted primarily to mature pine flatwoods; occurrence in county unsure.
Bachman's warbler				
Vermivora bachmanii	E	E	E	Possible only as a very rare migrant.
Kirtland's warbler				
Dendroica kirtlandii	E	E	E	Possible only as a very rare migrant.
Southern bald eagle				
Haliaeetus l. leucocephalus	E*	T	T	No known nesting in Hardee County, but seen over Peace River.
Osprey				
Pandion haliaetus	-	T	T	Rare in county.
Arctic peregrine falcon				
Falco peregrinus tundrius	E*	E	E	Possible migrant through area.
Southeastern American kestrel				
Falco sparverius paulus	-	T	T	Hardee County is within breeding range.
Audubon's caracara				
Caracara cheriway auduboni	-	T	T	Recent sightings in county.
Florida sandhill crane				
Grus canadensis pratensis	-	T	T	Nests in shallow emergent fresh marsh vegetation.
Least tern				
Sterna albifrons antillarum	-	T	T	Nests in interior and coastal Florida, utilizing beaches, spoil/fill sites, gravel roofs.

Table 9-6. ENDANGERED, THREATENED, RARE, AND SPECIAL CONCERN SPECIES WHOSE RANGES INCLUDE HARDEE COUNTY,[1] Continued. (Page 2 of 3)

Common & Scientific Names	Status F	S	NG[2]	Comments
BIRDS, Continued				
Florida scrub jay *Aphelocoma c. coerulescens*	-	T	T	Restricted to xeric oak scrubs.
Roseate spoonbill *Ajaia ajaja*	-	S	R	Primarily coastal; uses fresh marshes infrequently.
Louisiana waterthrush *Seiurus motacilla*	-	-	R	Migrant, frequents forest wetlands; occurrence in county unsure.
American redstart *Setophaga ruticilliapiensis*	-	-	R	May occur in county; is a migrant, prefers woodlands.
White ibis *Eudocimus albusis couperi*	-	-	S	Wetlands, mainly marshes.
Little blue heron *Florida caerulea*	-	S	S	Wetlands, mainly marshes.
Great egret *Casmerodius albus*	-	-	S	Wetlands, mainly marshes.
Snowy egret *Egretta thula*	-	S	S	Wetlands, mainly marshes.
Louisiana heron *Hydranassa tricolor*	-	S	S	Wetlands, mainly marshes.
Black-crowned night heron *Nycticorax nycticorax*	-	-	S	Wetlands, mainly marshes.
Yellow-crowned night heron *Nyctanassa violacea*	-	-	S	Wetlands, mainly marshes.
Least bittern *Ixobrychus exilis*	-	-	S	Wetlands, mainly marshes.
Coopers hawk *Accipiter cooperii*	-	-	S	County in wintering range.
Royal tern *Sterna maxima*	-	-	S	Sighted in region.
Florida burrowing owl *Athene cunicularia floridana*	-	S	S	Sighted in Hardee County range.
Southern hairy woodpecker *Picoides villosus audubonii*	-	-	S	Hardee County within range, utilizes varied habitats, including cypress swamps.

Table 9-6. ENDANGERED, THREATENED, RARE, AND SPECIAL CONCERN SPECIES WHOSE RANGES INCLUDE HARDEE COUNTY,[1] Concluded (Page 3 of 3)

Common & Scientific Names	Status F	Status S	Status NG[2]	Comments
MAMMALS				
Round-tailed muskrat *Neofiber alleni*	-	-	S	Range includes Hardee County.
Florida panther *Felis concolor coryi*	E	E	E	Varied habitat, no recent sightings.
Sherman's fox squirrel *Sciurus niger shermani*	-	S	T	Flatwoods, sandhills, rangeland.
Florida black bear *Ursus americanus floridanus*	-	T	T	Preferred habitat is thick swamps.
Florida longtailed weasel *Mustela frenata peninsulae*	-	-	R	Range includes Hardee County, varied habitat.

[1] Sources: Farmland Industries, Inc. DRI June 1979; U.S. Fish and Wildlife Service (1980).

[2] F = Federal Government Classification; S = State Classification; NG = Nongovernmental agency classification (Florida Committee on Rare and Endangered Plants and Animals).

E = Endangered. Species in danger of extinction if the deleterious factors affecting their populations continue to operate. These are forms whose numbers have already declined to such a critically low level or whose habitats have been so seriously reduced or degraded that without active assistance their survival in Florida is questionable.

T = Threatened. Species that are likely to become endangered in the State within the foreseeable future if current trends continue. This category includes 1) species in which most or all populations are decreasing because of overexploitation, habitat loss, or other factors; 2) species whose populations have already been heavily depleted by deleterious conditions and which, while not actually endangered, are nevertheless in a critical state; and 3) species which may still be relatively abundant but are being subjected to serious adverse pressures throughout their range.

R = Rare. Species which, although not presently endangered or threatened as defined above, are potentially at risk because they are found only within a restricted geographic area or habitat in the State or are sparsely distributed over a more extensive range.

S = Species of Special Concern. Species that do not clearly fit into one of the foregoing categories yet warrant special attention. Included in this category are 1) species that, although they are perhaps presently relatively abundant and widespared in the State, are especially vulnerable to certain types of exploitation or environmental changes and have experienced long-term population declines; and 2) species whose status in Florida has a potential impact on endangered or threatened populations of the same or other species outside the State.

*Officially listed for the Farmland Industries, Inc. site area by the U.S. Department of Interior (1980).

Table 9-7. ENDANGERED, THREATENED, RARE, AND SPECIAL CONCERN SPECIES WHICH WERE OBSERVED IN THE VICINITY OF THE FARMLAND INDUSTRIES, INC. HARDEE COUNTY SITE.[1]

Species	Status[2]		
	F	S	NG
American alligator Alligator mississippiensis	T	S	S
Gopher tortoise Gopherus polyphemus	-	S	T
Eastern indigo snake Drymarchon corais cooperi	T	T	S
Little blue heron Florida caerula	-	S	S
Great egret Casmerodius albus	-	-	S
Snowy egret Egretta thula	-	S	S
Louisiana heron Hydranassa tricolor	-	S	S
Black-crowned night heron Nycticorax nycticorax	-	-	S
Yellow-crowned night heron Nyctanassa violacea	-	-	S
Wood stork Mycteria americana	-	E	E
White ibis Eudocimus albus	-	-	S
Roseate spoonbill Ajaia ajaja	-	-	R
Bald eagle Haliaeetus leucocephalus leucocephalus	E	T	T
Osprey Pandion haliaetus carolinensis	-	-	T
Florida sandhill crane Grus canadensis pratensis	-	-	T
Florida burrowing owl Athene cunicularia floridana	-	S	S
Hairy woodpecker Picoides villosus audubonii	-	-	S
Sherman's fox squirrel Sciurus niger shermani	-	-	T

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[1] Source: Farmland Industries, Inc. DRI, June 1979.

[2] F = U.S. Department of Interior Classification;
S = State of Florida Classification;
NG = Nongovernmental Classification (Florida Committee on Rare and Endangered Plants and Animals).
See Table 8-6 for an explanation of the Federal (F), State (S), and Nongovernmental (NG) Classifications.

Table 9-8. DISTRIBUTION OF VEGETATION TYPES ON DISTURBED AND UNDISTURBED SITES ON THE FARMLAND MINE SITE PROPERTY.

FLUCCS Category	Type	Disturbed (Acres)	Undisturbed (Acres)	Total (Acres)
213	Pasture	1,960	456	2,416
230	Citrus Groves	1,757	160	1,917
262	Other Agriculture	95	58	153
411	Pine Flatlands-Palmetto Range	583	354	937
414	Coniferous Upland Forest	15	47	62
422	Hardwood Upland Forest	230	187	417
431	Mixed Upland Forest	35	276	311
621	Freshwater Swamp	320	885	1,205
641	Freshwater Marsh	285	107	392
	Total	5,280	2,530	7,810

Source. Farmland Industries, Inc. 1979. Development of Regional Impact, Application for Development Approval.

10.0
SOCIOECONOMICS

10.1 THE AFFECTED ENVIRONMENT

10.1.1 POPULATION, INCOME, AND EMPLOYMENT

Hardee County Population

The estimated population of Hardee County was 17,800 in 1978. By comparison, the estimated population was 1.3 million in the seven-county region and 284,000 in Polk County. Hardee County is predominantly rural, with two-thirds of the population living in unincorporated areas. Wauchula (1978 population of 3330) is the largest town. The population estimates for Hardee County (Table 10-1) have been benchmarked to a special census taken in November 1976 and, as a result, should be quite accurate.

Population growth in Hardee County has been low relative to the region or the state. The county's annual growth rate averaged 2.3 percent from 1970 to 1978 while the region and state averaged 3.5 percent (see Table 10-2). The county is also sparsely populated relative to the region or state. The county's population density was 28.3 persons per square mile, compared to 165.8 for the state.*

Hardee County's low growth rate reflects the minimal amount of inmigration to the county. The county is unique in the region in that its population change since 1970 has been nearly evenly split between natural increase and net migration (see Table 10-3). Consequently, the county has not had the experience of dealing with newcomers as a significant component of its population.

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*The county's land area is 629 square miles.

The age distribution of the county's population has remained nearly constant over the past 20 years. The population of the state, on the other hand, has grown older, primarily due to the in-migration of retired persons (see Table 10-4).

Hardee County Income and Employment

Income. Prior to the development of phosphate mining in Hardee County by CF Mining Corporation (CF) in 1978, the county's economic base consisted primarily of agriculture (e.g., truck crops, cattle ranching, and citrus) and a few manufacturing establishments (associated with lumber and food processing). As is typical in rural agrarian economics, per capita income was low. For example, the county's per capita income in 1977, estimated at $5305, was only 89 percent of the state average.

The agricultural sector is the largest source of earned income in the county; however, the services, trade, and government sectors are also major income providers (see Figure 10-1). Phosphate mining in the county by CF has provided a significant new source of income. However, nearly one-half of the employees at the CF mine live outside Hardee County.

Employment. The county's labor force was an estimated 8842 persons in August 1979. This implies a labor force participation rate of approximately 49 percent. Unemployment averaged 6.8 percent during 1978. During 1979 the unemployment rate ranged from 4.5 percent in April to 10.6 percent in August (Table 10-5). This variation was due to seasonal employment in agriculture, especially citrus.

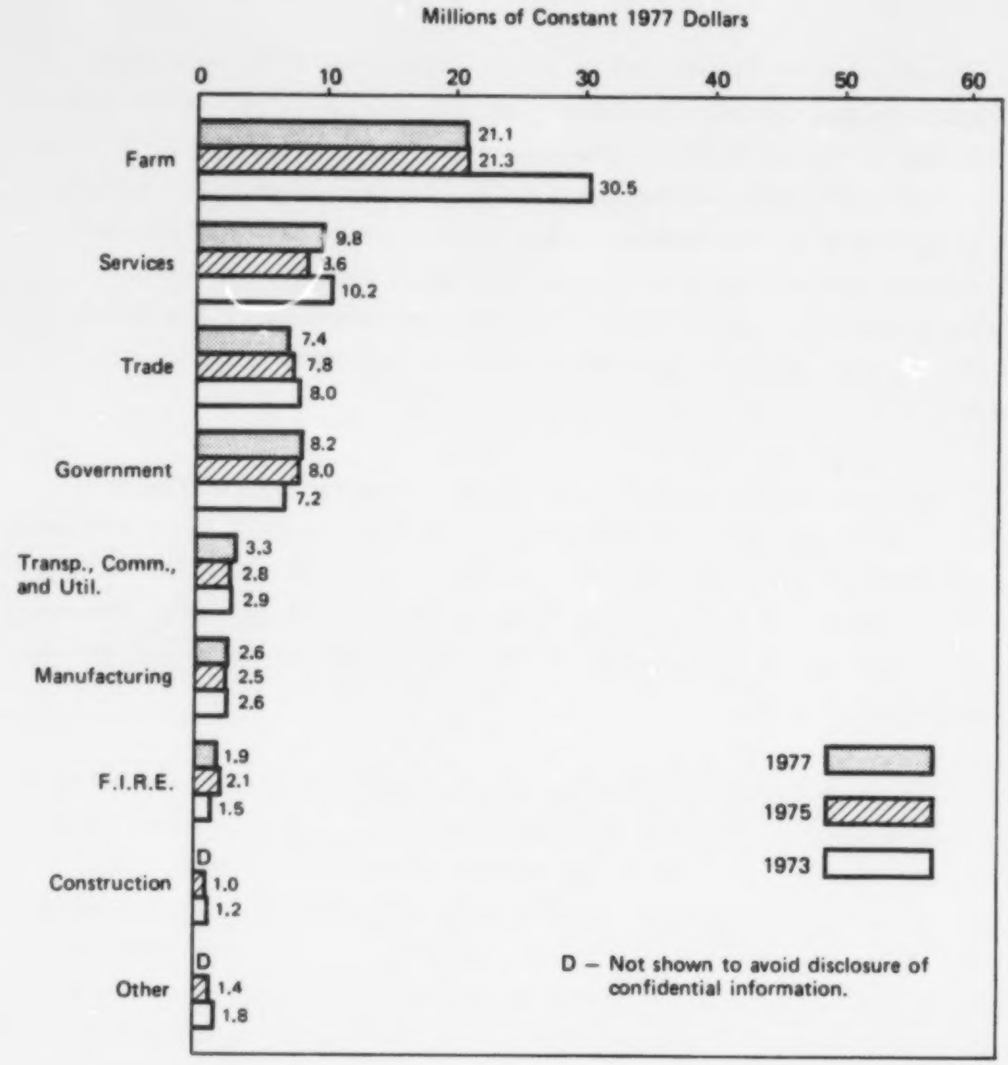

FIGURE 10-1. LABOR AND PROPRIETOR'S INCOME BY MAJOR INDUSTRIAL SOURCES--HARDEE COUNTY, 1973, 1975, 1977 (PLACE OF WORK).

SOURCE: U.S. Department of Commerce (1979).

Wage rates in Hardee County are low relative to the more urban counties in the region. Starting wages for most service, trade, clerical, and grove maintenance jobs generally range from $3.00 to $3.50 per hour. Average hourly earnings are only slightly higher. Since piece rates are used in most seasonal agricultural work, earnings vary depending on the productivity of the individual worker. On average, citrus pickers in Hardee County earn the equivalent of approximately $4.50 per hour (Florida Department of Labor and Employment Security 1979b).

Wages in phosphate mining and construction are substantially higher. Starting wages at the CF mine are approximately $4.00 per hour, and average earnings are in excess of $5.00 per hour. Similarly, wages in the construction trades range from $3.75 to $6.50 per hour, depending on the level of skill required (Florida Department of Labor and Employment Security 1979b).

The labor force in the seven-county region is large, consisting of 559,000 persons in August 1979, of which 6.8 percent were unemployed (Florida Department of Labor and Employment Security 1979c). Polk County, in particular, is a labor surplus area which has been classified by the U.S. Department of Labor as having "persistent unemployment". The seasonal peak in early spring associated with winter tourists and the citrus harvest is a major factor contributing to the region's unemployment problems (Florida Department of Labor and Employment Security 1979d).

Table 10-6 summarizes the characteristics of the unemployed in Hardee County and the region in July 1979. Hardee County had 202 unemployment compensation recipients, the majority of whom had previously worked in farming or manufacturing. There were no unemployment compensation recipients in the mining sector in Hardee County and only five unemployed miners in the whole region. There were 47 unemployed miners statewide, of which 32 were in SIC 14 (which includes phosphate mining).

As a result of unemployment, seasonal employment, and low wages (particularly in the agricultural section), poverty is a significant problem in the region. Nearly one-half of the black population and one-quarter of the total population in the region* will be below the poverty level in 1980 (Table 10-7).

Projections

Employment and population growth in the county will depend almost entirely on the expansion of the phosphate industry. The only other potential sources of basic employment growth are in-migration of retirees and agriculture, but neither is expected to be significant. Agriculture is likely to remain stable, and retirees are more attracted to the counties along the ridge to the east.

Phosphate industry employment in the region is projected to increase by about 2 percent per year until 1985 and decline thereafter (EPA 1978). Phosphate employment in Hardee County, however, is likely to increase at a higher rate and maintain a positive growth rate beyond 1985 since the county's phosphate reserves are just beginning to be tapped. Eleven firms presently own or have options on land containing phosphate reserves in Hardee County (Adley Associates, Inc. 1979a).

Numerous population projections have been made for Hardee County (see Figure 10-2). These projections vary widely in the amount of growth projected by 2000--from no growth to a doubling of the county's population. However, only one of these projections, the projection made

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*The region in this case consists of Planning District VII: Polk, DeSoto, Hardee, Highland, and Okeechobee Counties.

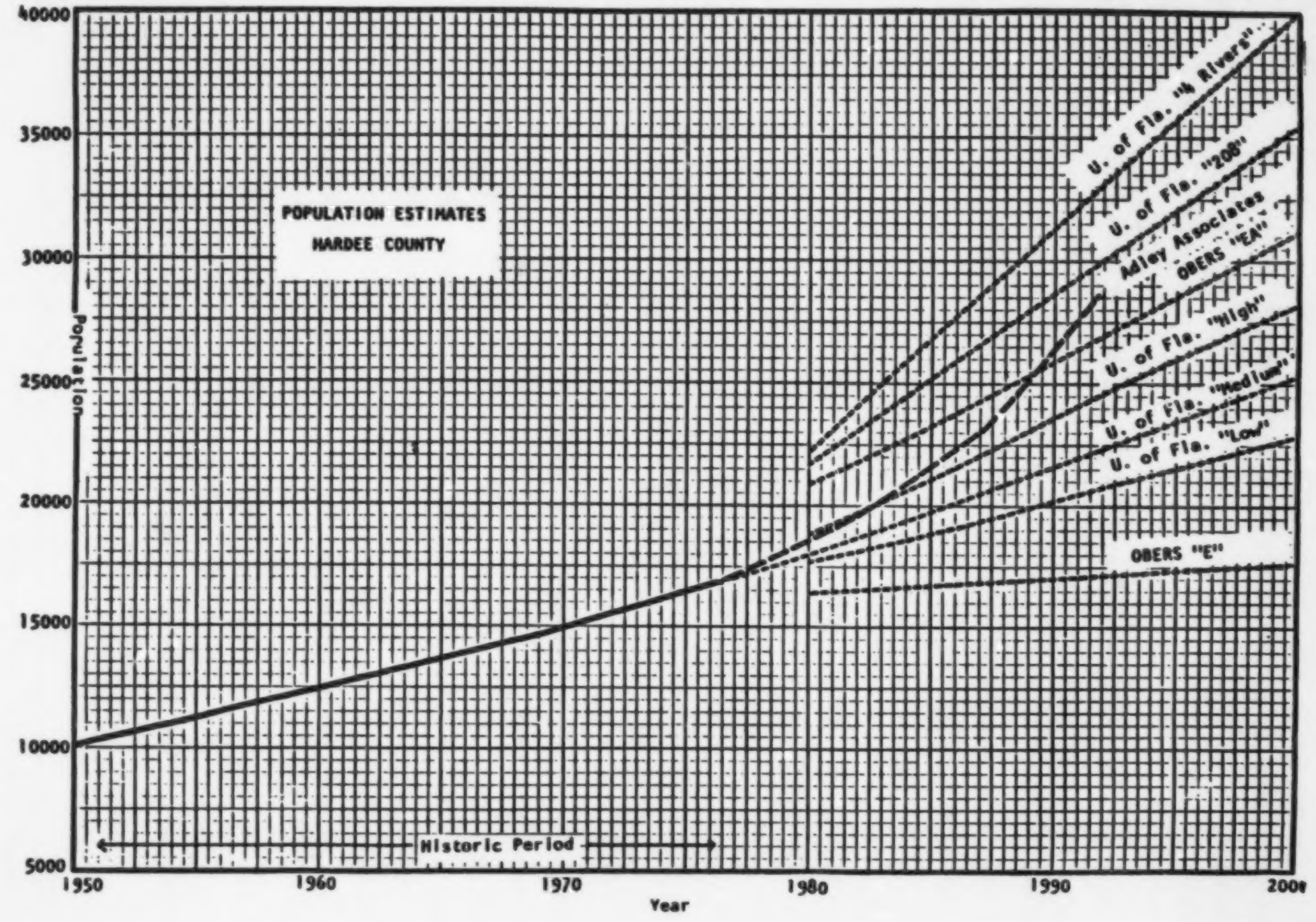

FIGURE 10-2. POPULATION PROJECTIONS FOR HARDEE COUNTY.

SOURCE: WOODWARD-CLYDE CONSULTANTS (1980) by Adley Associates, Inc. in 1979 for the Hardee County Comprehensive Plan, is based on a specific evaluation of the economic growth potential associated with phosphate mining in the county.

The Adley Associates, Inc. projections indicate that the population of Hardee County will increase from 17,800 in 1978 to approximately 28,800 by 1992, with 55 percent of this growth associated with phosphate mining, this is equivalent to an average annual growth rate of 3.5 percent. Of course, the actual growth in population will depend on several factors--the timing and size of new phosphate projects, the amount of secondary economic activity generated in Hardee County, and the number and location of non-local workers associated with the projects--all of which are subject to substantial uncertainty as well as control by local officials. In particular, the extent of public and private efforts to provide housing and community services and facilities will greatly influence the number of households that locate or relocate in Hardee County.

The Adley Associates, Inc. projections are based on the use of the University of Florida "medium" population projection as a reasonable estimate of future Hardee County growth without phosphate activity.* The University of Florida projections (developed by the Bureau of Economic and Business Research, Population Division) are based on the total state population allocated among the counties based on historical ratio-shares. The state projection is made with a cohort-component methodology with net migration assumptions keyed to 1960-1970 age-specific net migration rates. Low, medium, and high projections are made using net migration assumptions.** To the medium baseline, Adley

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*The OBERS E, OBERS EA, and UF 208 projections are described in EPA 1978.

**The assumptions used in these projections are described in Adley Associates, Inc. (1979a).

Associates, Inc. added the additional population they estimated would be associated with the following phosphate development scenario:

- 2 mines and 1 chemical plant in operation by the early 1980s
- 5 mines and 2 chemical plants by the lates 1980s
- 8 mines and 3 chemical plants by 1992.

This was done to indicate what population would result from such development, but did not necessarily indicate that such development was planned. This development scenario, which is based on a relatively slow movement of the phosphate industry into Hardee County, is consistent with the expectations of most local public officials' and most of these officials are basing their planning on this slow growth expectation.

10.1.2 LAND USE

Land Use and Ownership

Hardee County. Land use in Hardee County is predominantly agricultural. This is indicative of its economic base. Citrus groves, cattle range, and cropland comprise approximately half of the entire land area in the county (Table 10-8). According to the Florida Crop and Livestock Reporting Service, there were 44,084 acres in commercial groves in Hardee County in 1978. This total acreage has remained nearly constant for the past 5 years, but is nearly 6000 acres less than in 1969. Citrus production in the county has averaged approximately 13.3 million boxes per season during the past five seasons (Table 10-9).

Because of the predominance of agriculture in the county, development is rather limited (e.g., less than 1 percent of the county is urbanized). The urban areas are centered along U.S. 17, paralleling the Peace River. The three incorporated areas are Bowling Green, Wauchula (the county seat), and Zolfo Springs. Other small communities catering to agricultural activities are scattered throughout the county (EPA 1978).

Commercial and industrial land uses are restricted to the three urban areas but primarily to Wauchula; thus, the latter represents the most densely developed area, where commercial convenience centers have become more evident in response to residential growth. Even within the corporate limits, however, there are still large areas of open space (EPA 1978). Generally, other areas of Hardee County are occupied primarily by rangelands or wetlands.

The pattern of land ownership is an important component of the land use decision process because the economic interests and policies of the owner normally are the key determinants of the use of the land. Phosphate companies currently own or have options on slightly less than one-half of the land in Hardee County. The extent of phosphate company land ownership in the county is shown on Figure 10-3.

The Farmland Site. The proposed Farmland mine site occupies 7810 acres. The total acreage is currently leased to private agricultural interests. Figure 10-4 shows the land use and cover classifications present on the mine property. Actual acreages in each land use and cover classification are listed in Table 10-10.

There are 1917 acres of citrus groves on the site. Their productivity ranges from marginal to good, as many of them suffered freeze damage in 1970 and 1977 (Farmland 1979). The remaining 5893 acres are used primarily as grazing land for cattle. The nature of this grazing land varies considerably. Approximately 2416 acres are classified as improved or semi-improved pasture, where the native vegetation has been cleared and grasses have been either planted or allowed to volunteer. In addition, all the natural vegetative associations on the site are used as native range for cattle. This land use is represented by approximately 3477 acres and includes the pine flatwoods/palmetto range association, the wetland areas, and the upland forest areas. In the case of the pine flatwoods, the pine overstory has been almost completely removed in past years. Periodic burning has been practiced in

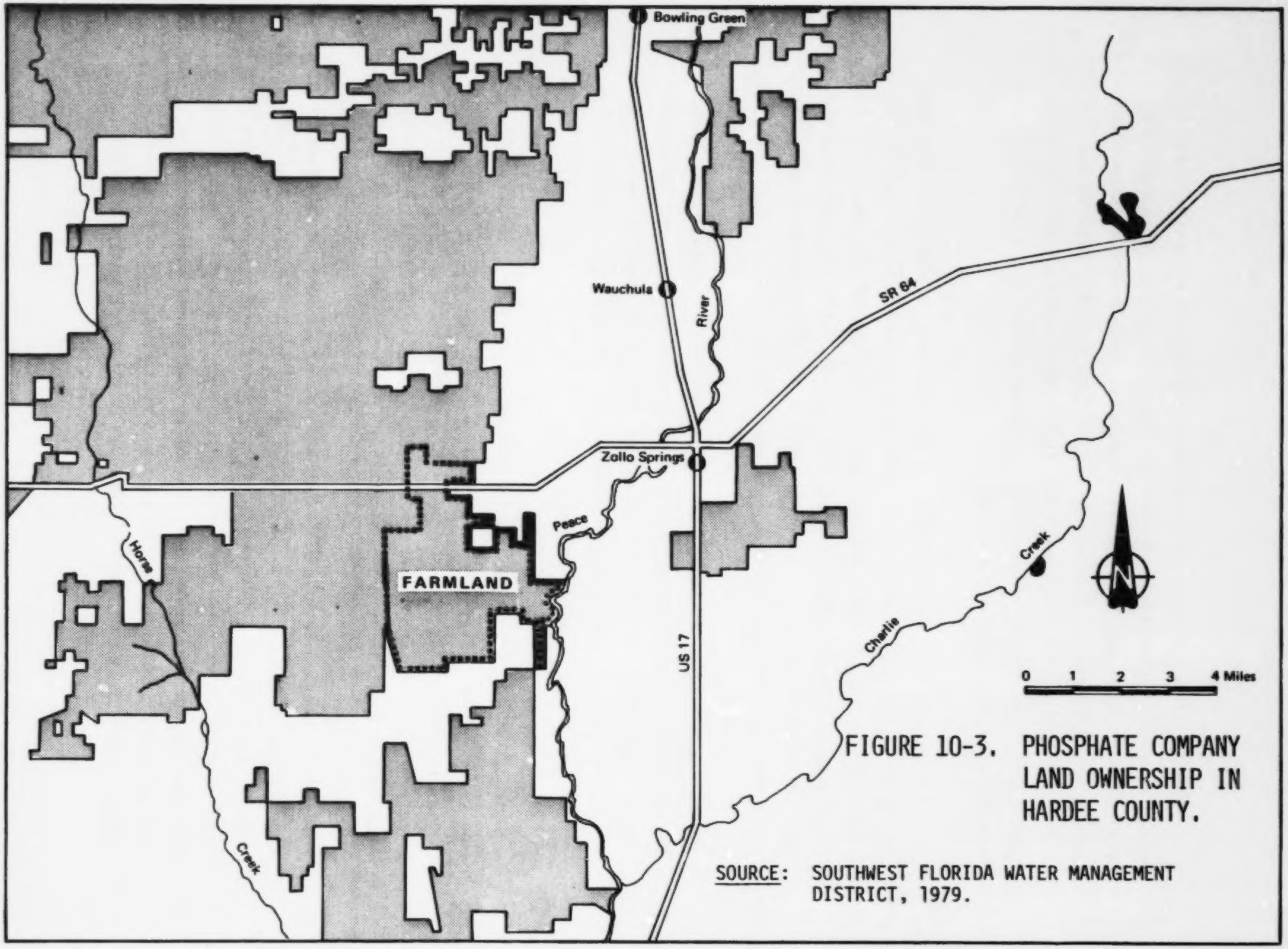

FIGURE 10-3. PHOSPHATE COMPANY LAND OWNERSHIP IN HARDEE COUNTY.

SOURCE: SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, 1979.

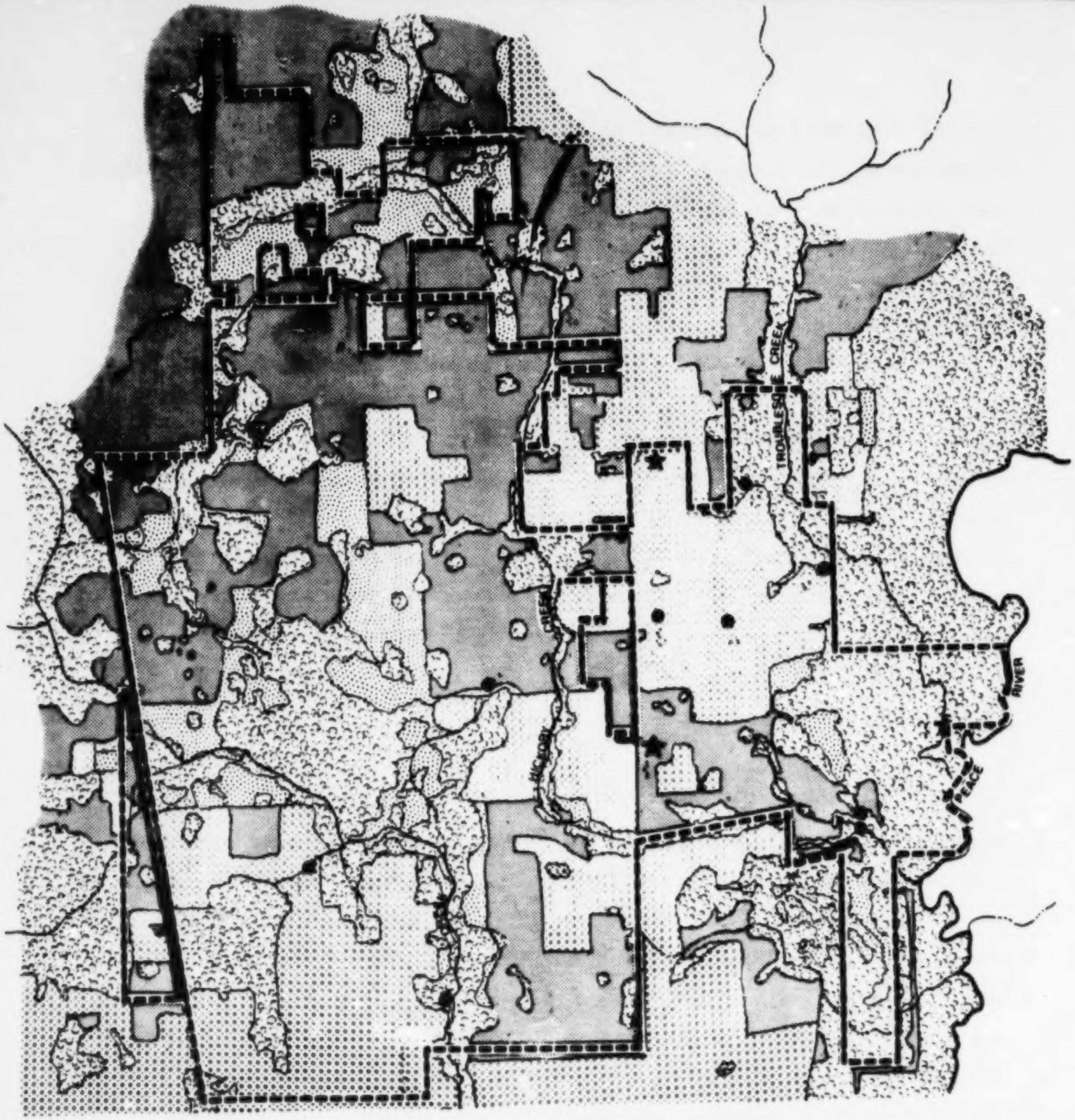

FIGURE 10-4. LAND USE ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

most of this area to maintain it as native range with palmetto and wiregrass as the dominant vegetation. Many of the wetland areas onsite, particularly marshes, show evidence of past attempts to drain them. Wetlands associated with the major drainage courses on the site have best retained their natural character despite such alterations and use (Farmland 1979).

Land use in the surrounding area is similar to that in the site area. Citrus production is especially prevalent to the south and east of the site along the Peace River. The unincorporated village of Ona is located approximately 1 mile northwest of the mine property. Ona has an estimated 88 residential structures and several commercial establishments (Adley Associates, Inc. 1979b). One small industrial facility, a post plant, is located adjacent to Ona to the southwest. In addition, there are several rural residential dwellings located along Highway 64 to the east of Ona.

Land Use Planning and Regulatory Controls

Introduction. Florida, like most states, historically has delegated land use planning and control to local governments. New state programs are directed primarily at strengthening local capabilities to plan and implement thorough land use controls and at strengthening state and regional capabilities to monitor development, provide uniform criteria, and coordinate planning activities. A few regulatory roles are held at state levels, but most powers to control land and resource use still reside with local agencies and commissions.

Planning and plan implementation powers in Florida are distributed between local and state governments and among special districts. Regional goal setting and evaluation are provided by regional planning councils in which local participation is voluntary (Imhoff 1976).

State Planning and Control. Section 380.06, Florida Statutes, and Chapter 22F-2, Florida Administrative Code, define the types of developments which are considered to be Developments of Regional Impact (DRI) and thus require the issuance of a Development Order (DO) by the local government. The process was created to control developments which have impacts extending beyond the jurisdiction in which they are located. Phosphate mining in excess of 100 acres per year or resulting in the consumption of more than 3 million gallons of water per day qualifies as a DRI for which an Application for Development Approval must be filed. Being in excess of these lower limits, Farmland applied for a DO in June 1979, with supplemental data submitted in August 1979, August 1980, and September 1980.

Regional Planning and Control. Two agencies provide regional planning services to Hardee County. The Central Florida Regional Planning Council (CFRPC), headquartered in Bartow, provides technical assistance and advice to local planning agencies in the county. Such services include the review of Development Approval Applications for DRIs. However, CFRPC has no power to regulate land use. In January 1980 and again in October 1980, the CFRPC recommended approval (with conditions) of the DO for Farmland's proposed mine and beneficiation plant.

The Southwest Florida Water Management District (SWFWMD) has jurisdiction over water-related planning and consumption in the region, including regulatory control over consumptive water use permits. In addition, SWFWMD assists CFRPC in reviewing water-related aspects of complex DRIs. Farmland has been granted a consumptive use permit for the withdrawal of the quantity of water needed for their proposed mining operation.

Local Planning and Control. The Hardee County Planning and Zoning Board is the designated local planning agency for Hardee County and administers the county's zoning ordinance. The Board also has been involved with the preparation of the elements of a comprehensive plan required by The Local Government Planning Act of 1975. This work was completed during the summer of 1980 with the publication of the Hardee County Comprehensive Plan (Hardee County 1980a). As back-up for the plan, elements dealing with the following subjects have been prepared:

- Conservation
- Recreation and Open Space
- Housing
- Traffic Circulation
- Intergovernmental Coordination
- Capital Improvements
- Economics and Population
- Utilities
- General Sanitary Sewer, Solid Waste, Drainage, and Potable Water
- Future Land Use

On October 23, 1980 the Hardee County Planning and Zoning Board voted unanimously in favor of rezoning of the proposed Farmland mine site from agriculture (A1) to mineral extraction (MI). Following this vote, the Hardee County Board of County Commissioners also voted unanimously in favor of a zoning change (November 13, 1980) and the issuance of a DO (December 4, 1980) for the proposed Farmland mine.

Other Planning and Control. Other regulatory agencies involved with phosphate mining include the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and the Florida Department of Environmental Regulation. Federal agency involvement is primarily related to the issuance of the NPDES discharge and dredge and fill permits.

10.1.3 TRANSPORTATION

Transportation Network

The existing transportation network in Hardee County is shown in Figure 10-5. U.S. 17 is the major north-south corridor, and State Roads (SR) 62 and 64 provide east-west access. The proposed site is directly served by SRs 64, 661, and 663 and the Fort Green-Ona Road, a graded unpaved road maintained by the county. In addition, the Seaboard Coastline Railroad has two tracks through the county, one paralleling the Fort Green-Ona Road and the other paralleling U.S. 17.

Traffic Levels

The existing traffic on the roads serving the site and on connecting highways is shown on Figure 10-6. The two-way traffic data shown are derived from Florida Department of Transportation (DOT) Average Daily Traffic (ADT) counts for the SRs and from sporadic one-day counts made by the Hardee County Engineer's office for county-maintained roads. More recent ADT counts by the Hardee County Engineer's office show an ADT of 447 for the north end of the Fort Green-Ona Road (March 1979), an ADT of 384 for SR 663 north of SR 62, and an ADT between 683 and 803 for SR 661. (SR 661 runs north-south through the eastern portion of the mine site.)

SRs 62, 64, 661, and 663 are two-lane undivided arterials with a minimum width of 24 feet. The most significant intersection is at Ona where SR 663/Fort Green-Ona Road crosses SR 64. In 1978, the highest traffic count was 2307 vehicles on SR 64 east of Ona. Given the light traffic, low peak-hour volumes, low percentage of trucks, relatively level terrain, and passing sight distances in excess of 1500 feet, the segments of the SRs serving the proposed site have a capacity of 1500 vehicles per hour and Service Level "A" Classification (Farmland 1979).

The only major traffic generator in the general area at present is the recently opened CF Mining Corporation phosphate complex, located

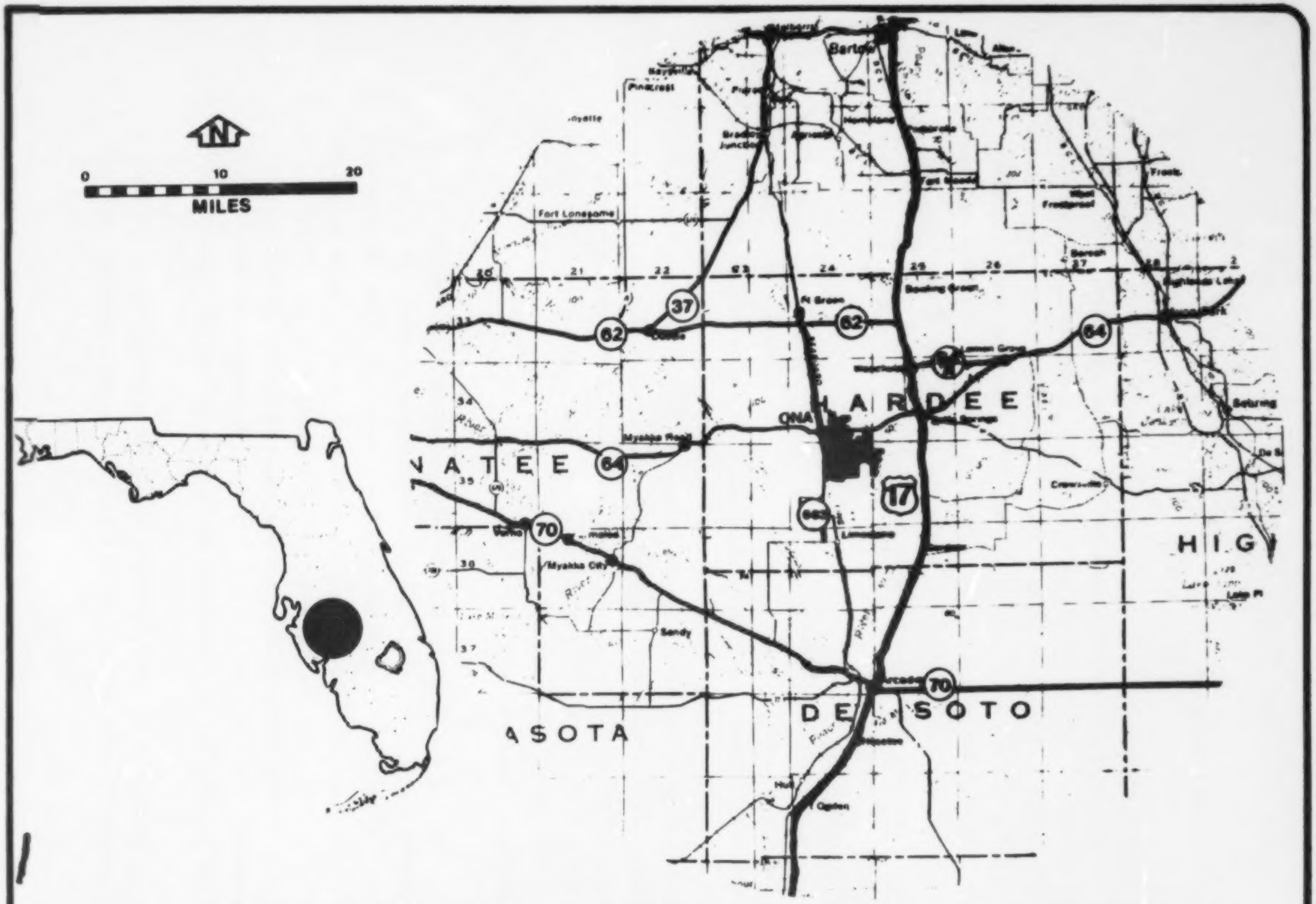

FIGURE 10-5. EXISTING TRANSPORTATION NETWORK IN THE VICINITY OF THE FARMLAND INDUSTRIES, INC. SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979.

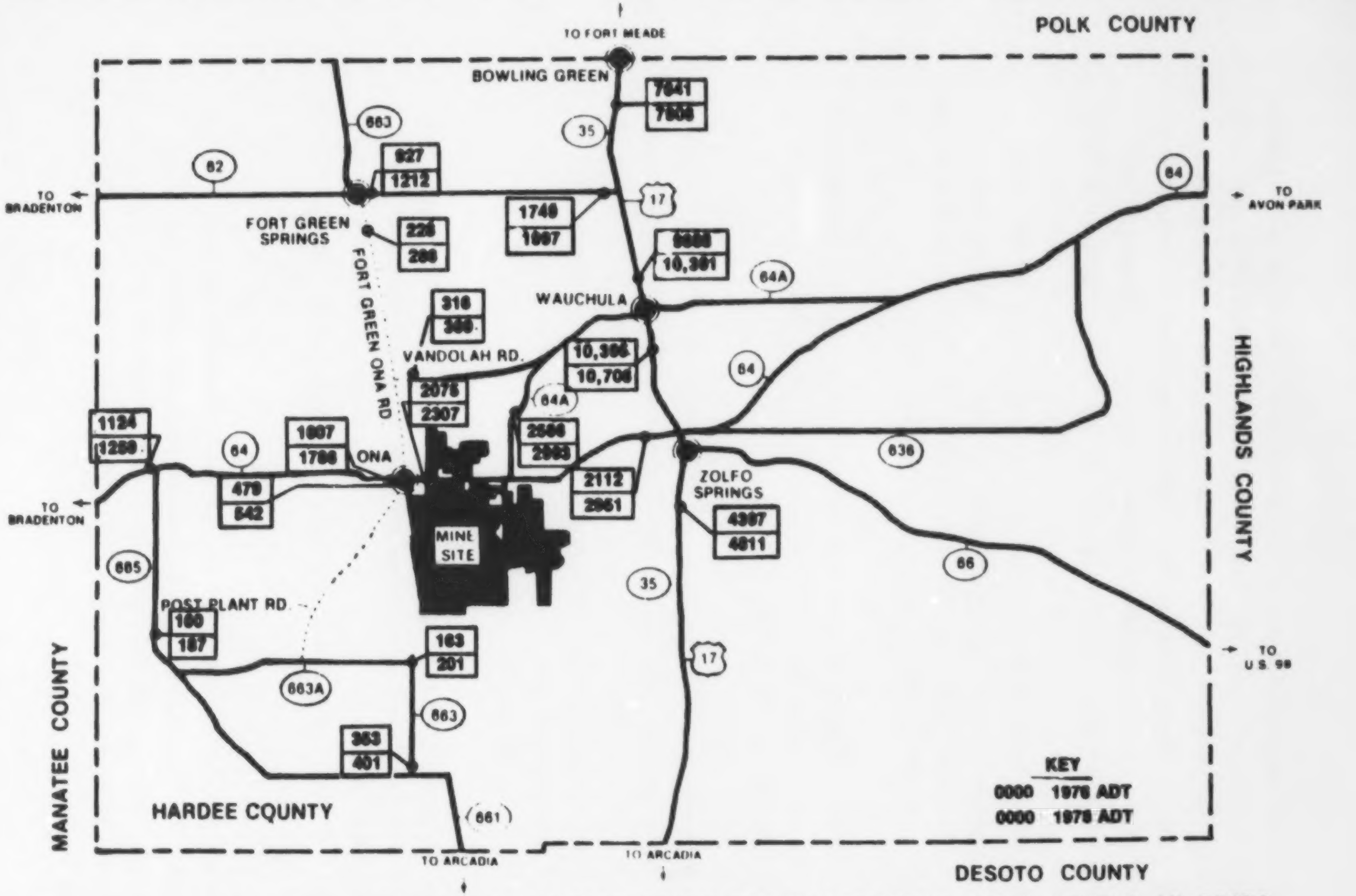

FIGURE 10-6. 1976 AND 1978 ANNUAL AVERAGE DAILY TWO-WAY TRAFFIC (ADT) LEVELS ON ROADS IN THE FARMLAND INDUSTRIES, INC. SITE AREA.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

about 10 miles north of Farmland's proposed site. Other primary traffic generators in the area are the dispersed ranching, vegetable, and citrus operations, and seasonal tourists. Peak traffic occurs during the winter period, at which time migrant labor is employed to harvest local crops and there is increased heavy-truck activity to transport the harvest to processing plants. Just east of Ona is a parking area which accommodates up to 70 citrus transport trailers. U.S. 17 is a popular route for many winter residents and tourists in transit to and from several of the southwest Florida coastal cities. Wauchula is the nearest urban center for shopping and schools, activities which generate trips by the dispersed rural population (Farmland 1979).

The Traffic Circulation Element of the Hardee County Comprehensive Plan (Adley Associates, Inc. 1979c) identified three major transportation issues facing Hardee County:

- status and need for improvements to U.S. 17
- the need or desirability of paving Fort Green-Ona Road between SRs 64 and 62
- the limited access to U.S. 17 available to residents east of Wauchula and the resultant increased traffic load on 64A within the city.

The Florida DOT currently has an engineering study in progress for U.S. 17. This study will determine the necessity and timing of the proposed four-laning of U.S. 17 from Bowling Green to Wauchula to Zolfo Springs. DOT has no other major planned improvements in the vicinity of Ona.

Paving the Fort Green-Ona Road, at an estimated cost of $2 million, is included in the county's Public Improvements Program (Adley Associates, Inc. 1979d), but this project is not scheduled within the next 5 years. The program also includes $100,000 per year for resurfacing existing roads.

10.1.4 COMMUNITY SERVICES AND FACILITIES

Housing

Hardee County had an estimated 6064 year-round housing units in 1976.* Of these, 3.4 percent were vacant (CFRPC 1978). According to a 1978 estimate, there are 4084 year-round housing units in the unincorporated areas of the county (Table 10-11).

The predominate type and tenure of housing in Hardee County is single-family owner-occupied. The number of mobile homes has increased in recent years, but multi-family units are still a negligible portion of the county's housing stock. CFRPC estimated that 75.8 percent of the housing units in 1976 were single-family units, 16.9 percent were mobile homes, and 7.4 percent were multi-family units (CFRPC 1978).

The major concentrations of housing in the county are in and around the incorporated towns and the outlying communities of Fort Green Springs, Limestone, and Ona. However, a substantial share of the housing is dispersed throughout the rural portion of the county, principally in scatter-site, single-family or mobile home units, "pocket" subdivisions, and a small number of mobile home parks (Adley Associates, Inc. 1979b).

The structural condition of much of the older housing in the county is poor. CFRPC estimated that nearly one-fifth (19.5 percent) of the units were substandard (i.e., structurally dilapidated or lacking some or all plumbing facilities) in 1976. The most severe concentrations of substandard units are in the urbanized areas, particularly the Magnolia Manor and Wauchula Hills sections of suburban Wauchula. However, the problems are also severe in the small outlying communities. An estimated 88 percent of the housing in Ona and 53 percent of the housing in Limestone is deteriorating or dilapidated (Adley Associates, Inc. 1979b).

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*This is the most recent housing estimate for the whole county.

Schools

Hardee County is served by one school district. Elementary students in grades 1 through 5 attend an elementary school in the incorporated town nearest their home, but all sixth graders and junior and senior high school students in the county are transported to Wauchula for school.

The capacity of these facilities and current enrollment figures are given in Table 10-12. The District Superintendent of Schools expects a total enrollment in excess of 4500 before the end of the 1979-80 school year. Enrollment varies during the year with a peak in late January coinciding with the annual influx of migratory labor.

Although current enrollment is near the capacity of existing facilities, the district has started construction on a new high school which should give the district the capacity to handle in excess of 5600 students. The new high school is being built with a classroom capacity of 800+ students and with support facilities adequate for 1205 students. This provides the flexibility to add classroom space as needed. The existing junior and senior high school buildings, which are located on the same block, will be used for grades 7, 8, and 9.

Fire Protection

Fire protection in the county is currently provided by three municipal volunteer fire departments. Service to the rural areas in the county is poor. However, the county has formed a committee to investigate ways of improving fire protection. The committee has requested that the Florida State Forestry Division prepare a comprehensive fire protection plan for the county.

Although these studies are not complete, the committee expects that the system improvements will consist of at least the following elements:

- The county would be divided into three zones, each served by a municipal fire department.
- Central dispatching would be provided through the Wauchula department.
- Back-up assistance (if required) would be provided by a second department.
- Bowling Green and Zolfo Springs would each hire one paid professional to maintain the equipment and to train the volunteers.
- Rural county residents would be taxed to support their share of fire protection costs (Town of Wauchula 1979).

The Wauchula Fire Department equipment is adequate and in good condition. It consists of two 3000-gallon-per-minute (gpm) pumpers designed for use with fire hydrants and two 500 gpm tank trucks designed for use in the rural areas. Bowling Green and Zolfo Springs each have one old pumper with a 500 gallon tank. Both the Bowling Green and Zolfo Springs Departments need a new or upgraded truck with a 900 to 1200 gallon tank (Town of Wauchula 1979).

The current fire insurance ratings are 10 for Zolfo Springs, 9 for Bowling Green, and 6 for Wauchula. A rating of 7 is about average for a paid professional department.

10.1.5 PUBLIC FINANCE

Revenues

Revenue sources for Hardee County jurisdictions are summarized in Tables 10-13 and 10-14. Intergovernmental transfers and property taxes are the major revenue sources for the county government. Service charges and intergovernmental transfers are the major revenue sources for the municipalities. Currently, school district operating revenues are evenly split between local property taxes and state sources; how--ever, state sources provide approximately three-fourths of the school district's revenues for capital expenditures and debt service.

Although the property tax base has increased significantly in the past few years, property tax revenues have not increased very much because the county has opted to reduce tax rates. For example, the county's taxable value increased 114 percent from 1976 to 1979, but total taxes levied increased 49 percent. This was accomplished by reducing the county-wide mill levy 12 percent over this period (Tables 10-15 and 10-16).

Expenditures

Expenditures for various government functions by Hardee County jurisdictions are shown in Table 10-17. The county's major expenditure categories include general government, public safety, and economic development. The municipalities' major expenditures are for public works. Expenditures by category for the school district were included in Table 10-14. The district's FY 1980 budget includes $5.9 million for general instruction and support. In addition, the district will spend nearly $6 million for construction of a new high school.

10.1.6 CULTURAL RESOURCES

Cultural Overview

Historically, the flatland areas of the proposed project area presented very few easily obtainable resources, floral or faunal. Because of its wet nature during the growing season, the land was not well-suited to the types of maize horticulture practiced by Florida Indians. Thus, the flatlands on the Farmland property were probably not a hospitable environment to the south Florida Indians and were utilized only very sporadically. In fact, it is only since power machinery for digging drainage ditches and year-round watering holes became available that the land could be improved sufficiently for use as pasture.

The relative cultural barrenness of the flatlands is reflected in the history of Indian and white settlement of that physiographic zone. Recent surveys of flatland areas in Pasco (Seabury 1974; Williams 1974), Hillsborough (Browning 1975; Hemmings 1975; Padgett 1974), Manatee (Browning 1975; Padgett 1974), DeSoto (Milanich and Martinez 1975), and Hardee (Milanich, Marrinan and Martinez 1975; Milanich and Willis 1976 and 1977; Wood 1976) Counties have demonstrated that the region never was occupied to any great extent by aboriginal populations.

The majority of sites present are small camps, usually adjacent to a water source. Also reported for northern Hardee County are several earthen mounds of artificial construction and unknown use, some of which contain artifactual material (Wood 1976). As one moves westward out of the flatlands toward the coastal strand, the number of sites increases, especially when the ecotone between the coastal and flatland habitat is reached. These occupations extend up the rivers into the flatlands for a way, but decrease significantly away from the rivers. In the same manner, as one moves eastward toward the central Florida highlands, the number of sites increases and extends for a short way into the flatlands along rivers flowing down from the higher central portion of the state.

Hardee County is located between two discrete and well-defined culture regions. The first, the coastal portion of Manatee and Sarasota Counties to the west, was the southern extent of the various cultures which inhabited the peninsular Florida Central Gulf Coast from about 2000 B.C. to the historic period (Archaic, Norwood, Deptford, Weeden Island, Safety Harbor). To the southeast is the Bell Glade culture region, centered in the Lake Okeechobee Basin but extending an unknown distance northward up the Kissimee River drainage and west along the

Caloosahatchee (Sears 1974). The latter region was occupied intensively from about 500 B.C. into the historic period. Hardee County, as well as the coastal strand and Lake Okeechobee Basin, contains Archaic sites dating back at least to 5000 B.C. Paleo-Indian materials dated to 8000 B.C. have also been found in all three regions (e.g., Clausen, Brooks and Wesolowsky 1975). The Archaic sites and the few Paleo-Indian sites are generally small camps found around old sinks (some now silted-in). Quite likely, nomadic hunters utilized the sinks to mine flint and obtain water in what was then arid South Florida (Thanz 1975).

Thus, because of the relative sparseness of its habitats after about 2000 B.C., Hardee County served as a "no-man's land" or buffer zone between the Gulf coastal cultures and the cultures of the Lake Okeechobee Basin. Previous to that time, all three regions were occupied only sporadically by small populations of nomadic Paleo-Indian and Archaic hunters. At no time during the prehistoric period was the region ever an important culture area.

The period of white and historic Seminole occupation of Hardee County began just previous to the mid-nineteenth century. By a treaty negotiated by General Alexander Macomb in 1839 with the Seminole Indians, certain of the Seminoles agreed to move east and south of the Peace River, leaving Hardee County open to settlement (Mahon 1967). The year after the war ended (1843), preliminary surveys of what is now the county were begun, and gradually, a few settlers moved into the region. However, by 1850 less than 12 families lived in what is now Hardee County (Plowden 1929).

Fort Green, a non-military fortified homestead, was built between 1854-1856 by James Green (Plowden 1929). The log structure was located west of present day Fort Green Springs, most likely just north of SR 62 in the southeast 1/4 of the southeast 1/4 of the northeast 1/4 of Section 22.

Other forts in present-day Hardee County included Fort Choconicla, established October 26, 1849, next to a trading post at the confluence of Payne Creek and the Peace River. The fort was built near the place where Captain George S. Payne and D. Whidden (who ran the trading post) were killed by Seminoles on July 14, 1849 (Plowden 1929). Payne Creek is named after Captain Payne.

In 1851 Fort Hartstuff was built 2 miles southwest of the present location of Wauchula, forming the center near which the town later grew. Military action in Hardee County during the Third Seminole War was restricted to skirmishes on the Peace River. The soldiers stationed in Hardee County were not impressed with the nature of the terrain, and one described it as "...little more than a vast dreary solitude, stretching out in every direction, inhabited chiefly by wild beasts and reptiles" (Plowden 1929).

The inventory archaeologists inspected the earliest Hardee County Township plats at the Hardee County Clerk's Office and obtained copies of the original state surveys and field notes of the project area. The maps examined include Township 34 South, Range 24 East by Samuel Hamblen 1872; Township 35 South, Range 24 East, and Township 35 South, Range 25 East also by Hamblen 1871; and Township 34 South, Range 35 East by John Jackson 1854. These maps revealed only one artificially constructed feature within the survey boundaries. In the Township 34 South, Range 24 East 1872 map by Hamblen is shown a trail marked "Road to Tampa" which just barely intersects the survey area running northwest through the northeast 1/4 of the northeast 1/4 of the southwest 1/4 of Section 26 from its origin near Hickory Creek (out of property). Unfortunately, the Tampa Road is not distinguishable in aerial photographs, nor could it be located by a ground search. That this road is no longer discernable from native terrain is borne out by the fact that it could not be located in 1975 (Milanich and Martinez 1975) during an intensive survey of the Carlton Ranch property to the north and west of the present survey through which a great portion of this trail passes.

The inspection of the earliest plats at the Hardee County Clerk's Office also produced copies of the original state surveys and field notes of the project area in Sections 7 and 8, Township 35 South, Range 24 East. This area was surveyed in 1843 by Sam Reid. The maps show nothing on the tract except large areas of prairie and gallberry thickets.

In addition to personal assessments of the virtues of life in Hardee County, Sam Reid's field notes contain entries regarding the timber potential of lands surveyed, thus illustrating the first major economic exploitation of Hardee County timber. Pine was taken primarily from the flatwoods area, while cypress was harvested from swamps and the floodplain of the Peace River. During the survey of this area numerous old pine stumps were observed.

In the 1880s a railroad was built, tying eastern present-day Hardee County to northern Florida. By the 1890s several small towns sprang up, and by 1900 large scale cultivation of vegetables and citrus began near the Peace River. In 1912 the Charlotte Harbor and Northern Railroad was built through the property. This is the present-day Seaboard Railroad. Ona, a town of about 300 persons, was moved from eastern Hardee County to its present location, and Vandolah, now deserted, was founded. Thus, the major modern occupation and exploitation of the Farmland site post-dated the building of this railroad.

In the 1920s Hardee County participated in the south Florida economic boom. Vegetables, citrus, and hogs were exported north along the railroads. Cattle also became of major importance, and it is probable that it was at this time that the project area was first improved for cattle production. Modern Hardee County was founded in 1921, and named after Cary A. Hardee, Governor of Florida at that time (Farmland 1979).

Inventory of the Farmland Mine Site

In March and April of 1977 an intensive inventory archaeological survey of the Farmland mine site was carried out by personnel employed by the Florida State Museum (Milanich and Willis 1977). The survey revealed twelve previously unknown scatters of aboriginal artifacts on the property, three of which warranted listing in the Florida Master Site File. Although these three warranted listing, no mitigation was recommended because they had already been extremely disturbed by past agricultural practices. Descriptions of the twelve sites taken from Milanich and Willis (1977) follow:

> "Aboriginal Site #1--Location is T35S, R24E, NE 1/4 of SE 1/4 of SW 1/4 of Section 10, approximately 200 meters south of Oak Creek Islands. Surface Material recovered consisted of three flint chips, two of which showed use scars, along with one small triangular Pinellas projectile point. Subsurface testing revealed no further artifacts nor any evidence of a midden strata. No further tests recommended.
>
> Aboriginal Site #2--Location is T35S, R24E, S 1/4 of SW 1/4 of Section 2. This site consists of a disperse scatter of flint debris; 20 non-utilized flint chips, 11 utilized flint chips and 3 utilized blade fragments, found over a 1/4 mile stretch of sand trail, 50-100 meters north of a small swamp draining into Oak Creek. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.
>
> Aboriginal Site #3--Location is T35S, R24E, NE 1/4 of NW 1/4 of NE 1/4 of Section 4 in plowed fire trail through pine flatwoods 50 meters NW of dry creek bed supporting bayhead vegetation. Materials recovered were 8 non-utilized flint chips, 16 utilized flint chips and 2 utilized blades. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.
>
> Aboriginal Site #4--Location T35S, R24E, NW 1/4 of SW 1/4 of SE 1/2 of Section 1 near the summit of a sand rise in the center of an extensive orange grove 1/2 mile west of Site #5. Materials recovered here included 1 non-utilized flint chip and 1 Archaic stemmed projectile point. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.
>
> Aboriginal Site #5--Location T35S, R24E in the E 1/4 of SE 1/2 of Section 1 along a 1/2 mile long edge of a sandy rise planted in orange grove within 100 meters of swamp edge whose contour borders

the west side of Troublesome Creek. Due to the extensive surface area exposed through orange grove cultivation a very intensive search produced 73 non-utilized flint chips, 112 utilized flint chips, 4 utilized blades, 1 expended flint core, 1 large flake scraper, 1 bifacial tool mid-section, 1 projectile point tip, 3 projectile point stem fragments (Archaic), 1 stemmed Archaic point and 1 Hardee Beveled point. Also found was 1 minute, sand-tempered plain pottery rim-sherd (non-diagnostic). Subsurface testing revealed no further artifacts or midden zone. Although a relatively large number of artifacts were recovered at this site (for Hardee County) it is not recommended for further testing or preservation since heavy equipment cultivation of the orange grove has destroyed the integrity of the site, exposing these artifacts and eliminating whatever midden strata might have existed prior to such cultivation. This site will, however, be listed in the Florida Master Site File.

Aboriginal Site #6--Location T35S, R24E, NE 1/4 of SW 1/4 of NE 1/4 of Section 1 on a 40-acre hillside orange grove projection into the swamp forest vegetation bordering the west side of Troublesome Creek. Here extensive orange grove cultivation also exposed almost the entire surface of the hillside to intensive scrutiny. Forty non-utilized flint chips, 51 utilized flint chips, 6 utilized blades, 1 triangular Pinellas projectile point and 1 minute, sand-tempered pottery sherd was recovered. Subsurface testing revealed no further artifacts or midden zone. This site will be listed in the Florida Master Site File, but due to the same reasons listed for Site #5, is not recommended for further testing or preservation.

Aboriginal Site #7--Location T35S, R24E, SE 1/4 of NE 1/4 of NE 1/4 of Section 1 on the western slope of a southerly projecting sand hill (also planted in orange trees) bordering the east side of the swamp forest vegetation of Troublesome Creek. The major portion of this site is just east of the survey boundary lines but the artifactual scatter extended into survey property. Materials recovered from the exposed surface of this approximately 20-acre section of orange grove included 13 non-utilized flint chips, 43 utilized flint chips, 1 triangular Pinellas point base, 2 projectile point stem fragments - Archaic, 2 stemmed Archaic projectile points (one appearing to have been heat-treated). Subsurface testing revealed no further artifacts or midden zone. This site will be listed in the Florida Master Site File but due to the identical reasons listed for Sites #5 and #6 is not recommended for further testing or preservation.

Aboriginal Site #8--Location T35S, R24E, NE 1/4 of SW 1/4 of SW 1/4 of Section 1 near the summit of a sandy rise in the middle of an extensive orange grove. Materials recovered include 4 non-utilized flint chips and 4 utilized flint chips. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.

Aboriginal Site #9--Location T35S, R24E, SW 1/4 of SW 1/4 of NW 1/4 of Section 14 on rise adjacent to west ledge of Oak Creek swamp in plowed perimeter around orange grove. Only one utilized flint chip was located. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.

Aboriginal Site #10--Location T35S, R24E, NE 1/4 of NW 1/4 of NW 1/4 of Section 14 in sand trail separating orange grove and pasture. Only 1 non-utilized flint chip was recovered here. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended.

Aboriginal Site #11--Location T35S, R25E, NW 1/4 of NW 1/4 of SW 1/4 of Section 7 in the NE corner of a cleared field adjacent to western border of the Peace River swamp forest flood plain. Surface materials recovered included 2 non-utilized flint chips. Subsurface testing recovered 1 non-utilized flint chip in the upper sod zone; no midden strata was encountered. No further tests recommended.

Aboriginal Site #12--Location T35S, R25E, SW 1/4 of NW 1/4 of SW 1/4 of Section 7 in SE corner of cleared field adjacent to western border of the Peace River swamp forest flood plain 1/4 mile south of Site #11. Surface materials recovered include only 1 utilized flint chip. Subsurface testing revealed no further artifacts or midden zone. No further tests recommended."

Milanich and Willis (1977) also state that a paleontological site has also been reported from the property. It was reported that a partial, badly-deteriorated mammoth skeleton was removed from Hickory Creek by a Wauchula resident in 1965. However, no paleontological remains were found on the site by Milanich and Willis.

10.1.7 VISUAL RESOURCES

Introduction

The visual resource analysis of the proposed Farmland site consists of two elements:

- a description of the physical environment
- an analysis of the human perception of that physical environment

The physical environment is comprised of three basic features: landform, vegetation, and structures. These physical features are described in terms of form, line, color, and texture. Site visits were conducted in 1979 to obtain necessary data.

Human perception of the physical environment encompasses a wide range of factors. The following are included in this analysis:

- typical viewpoints
- distance between viewer and object
- number of times seen
- duration of view
- physical qualities of pre-empted areas in the region (areas that have been reserved for recreation, nature study or aesthetic appreciation)
- nearby public use areas

Physical Environment Description

The existing landform of the proposed Farmland mine site is nearly flat to slightly rolling. Three creeks with some steeply incised banks cut through the property, creating some variation in relief. Dense vegetation, however, tends to obscure the variation in topography. Irregular-shaped bands of tall rounded trees with dense understory grow along the creeks, which are separated by grassy pastures and citrus groves. The pastures are rectangular with hedgerows along some fence lines and occasional clumps of coniferous or hardwood forest within. The citrus groves are uniform and rectangular. Patches of palmetto, swamp or marsh vegetation occur sporadically throughout the site. The natural areas, pastures, and groves create a mixed pattern of open and enclosed spaces. The dominant colors are various shades of green and gray and some tan from dried vegetation.

The site is located in a rural area, and nearly all structures on the site or nearby are either farm housing or associated with agriculture. The site boundary is within 3000 feet of the small community of Ona which has approximately 88 dwelling structures. Most are small, one to two story buildings and are made primarily of wood. Also, there is a small wood mill in Ona with a large two story shed.

Human Perception Analysis

The most frequent public views of the proposed Farmland mine site would be from cars on SRs 661, 663, 64, and East Whidden Road (Figure 10-6). Views into the site from along these roads are sometimes obstructed by dense vegetation, orchards, or parcels not owned by Farmland. Open areas (unobstructed views) range in distance between 0.5 and 1.5 miles. The flat terrain and vegetation prevents long, sweeping vistas.

As indicated in Figure 10-6, the number of viewers to pass the mine site by car varies between 201 on SR 663, and 2307 on SR 64 (based on ADTs and one person per car). This compares to 10,391 persons calculated for U.S. Route 17 (the nearest U.S. Highway), which is 7 miles away. The heaviest traffic is along SR 64 followed by SR 661. This number may increase should plans for improvement of these roads be implemented. The typical viewer would see the site only briefly in passing, there are no major places to stop and view the site for longer periods of time. Of course, local residents, including those in Ona, would be able to continuously view the site. The site is not visible to canoers on the Peace River because of dense vegetation.

A survey of regionally pre-empted areas suggests a preference in central Florida for water-based recreation and natural areas (EPA 1978). The nearest recreation areas to the mine site are Pioneer Park (5 miles) and the Peace River canoe trail (on the eastern property boundary). Pioneer Park, which borders the Peace River near Wauchula, has both day and overnight use. The Peace River canoe trail has no public land acquisition associated with the program, and no usage data are available (EPA 1978). The river is a potential nominee for scenic river status, and the site property adjacent to the Peace River has physical qualities similar to other pre-empted areas in central Florida. However, no such state or local recreation purchases are anticipated in Hardee County.

10.2 THE ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

The proposed mining and processing of phosphate rock at the Farmland site and subsequent reclamation of disturbed land will alter the existing socioeconomic environment in the site region. Unlike the previous sections, this section is not arranged by project component so that the impacts of the alternatives for each component can be identified. In the case of socioeconomics, the only alternatives examined are the proposed action (as a whole) and the no action alternative.

10.2.1 THE PROPOSED ACTION

POPULATION, INCOME, AND EMPLOYMENT

Hardee County Employment and Population

Direct Employment. Table 10-18 summarizes the projected direct employment created by the proposed Farmland mining activities. Construction will employ an annual average of 285 workers during the 18 month construction period, with a peak of 450 workers to be employed during the second year. It is assumed that the construction work force will consist entirely of commuting residents of other counties (90 percent) and Hardee County residents (10 percent). A work force of about 327 is expected for the mining operation.

Farmland estimates that 25 percent (82) of its operations employment will be current Hardee County residents, and that nearly 25 percent

(82) of its employees will relocate in Hardee County. These estimates are similar to those experienced by CF Mining Corporation in operating their Hardee County mine and beneficiation plant (CF Mining Corporation 1980). The remainder of the work force will commute because of (1) the relatively short commuting distance from Polk County; (2) the mobile nature of that work force; (3) the relative availability of housing and services in Polk County; and (4) the current cost of housing.

Secondary Employment. Farmland conducted a survey of 109 firms which are suppliers to existing phosphate operations and are currently located in Polk and Hillsborough Counties (Farmland 1980a). Approximately 23 percent of the firms responding would shift all, or a portion of, existing facilities to areas of new mines.

The U.S. Bureau of Mines estimated in 1974 that each direct phosphate industry job creates 6.155 new jobs (Bureau of Mines 1974). Given the well-developed phosphate support industry in the region*, this figure is considered an upper limit. However, until phosphate industry activity reaches a "threshold" level in Hardee County that is attractive to relocation of support services, indirect and induced employment opportunities will accrue to existing firms in neighboring counties and not to Hardee County. In addition, experience with energy development projects in other rural states has indicated that in areas of "new development" it took a period of at least 3 years of operation before nonbasic support activity responded to new basic (i.e., phosphate) industry jobs (Denver Research Institute 1979). Because of the uncertainty over the level and timing of phosphate industry activity in Hardee County, a two scenario approach to secondary employment is used to estimate impacts (see Table 10-19).

The high scenario assumes a full employment (indirect and induced) multiplier of 6.155 for project operations, with 25 percent of the new indirect and induced employment relocating in Hardee County by 1985. Under this scenario, it is assumed that secondary employment from operation of the proposed mine would be on the order of 2000 jobs.

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*The region in this case consists of Planning District VII: Polk, DeSoto, Hardee, Highlands, and Okeechobee Counties.

An alternate low case scenario was evaluated using a multiplier 1/2 of the U.S. Bureau of Mines figure and 25 percent relocation by 1985. This is considered a conservative estimate because only 10 percent of the construction labor is expected to be hired locally. Under this scenario, the secondary employment attributable to operation of the proposed mine would be 1000 jobs.

Population. The Hardee County population increase resulting from the proposed project will be a function of the number of relocating employees (see previous section) and household size. Estimates of household size and type for the central Florida region indicate that the average number of persons per household will steadily decrease through 1995 (EPA 1978). The Hardee County population increase attributed to direct and secondary employment from the project can be made by multiplying the number of relocating employees times the appropriate estimate of persons per household (Table 10-19). In making these determinations three assumptions were made: (1) that relocating employees will come from Polk County with those persons per household characteristics; (2) that the project will have a 1981 construction start date with employees relocating by 1985; and (3) that a continuous annual rate of decline in persons per household between 1980 and 1995 Polk County projections, resulting in a 1985 persons per household figure of 2.66. Since the secondary employment level is dependent upon which scenario is used (see previous section), analyses for each are presented (see Table 10-19).

Under the high scenario assumptions, mine operations would result in a population increase of approximately 1500 by 1985; whereas, under the low scenario the operation induced population increase (by 1985) would be on the order of 900. In addition, it is estimated that on the order of 80 people would be added to Hardee County as a result of construction relocation--bringing the total to 921-1616. Adley Associates, Inc. (1979a) estimate the Hardee County population in 1985 to be about 21,700. This figure includes population generated by phosphate mining.

Income

Personal Income. In 1978 Farmland estimated that construction labor expenditures would total $11,750,000 and that the annual operations payroll would be $5,333,900. Combined this totals $118,410,000 over an operations life of 20 years. Table 10-20 shows a breakdown of that income. Inflated by 9 percent annually (Florida Department of Labor and Employment Security 1979d), the estimated 1980 expenditures for construction labor are about $14 million. Approximately 10 percent ($1.4 million) will go to Hardee County residents, and 85 percent ($11.9 million) will be spent in the seven county region. Similarly, the 1984 annual operations payroll is inflated to $6.3 million (1980 dollars). All of the operations payroll of $6.3 million will accrue in the seven county region, with 50 percent ($3.2 million) going to Hardee County residents. Without inflation, payroll expenditures for the operating life of the project will exceed $126.0 million.

There is no exact means of estimating secondary income (indirect and induced) generated by the project. However, it has been estimated that for every dollar of direct income generated, $3.363 of the indirect and induced income are created (Bureau of Mines 1974). In 1984, an estimated $21.2 million of secondary income would be created for region residents. Approximately 25 percent ($5.3 million) would go to Hardee County residents.

The per capita income of Hardee County will increase with the construction and operation of the proposed mine, for the average annual (1978) salary of a Farmland employee ($16,348) will be more than three times the 1977 Hardee County per capita income ($5305). Since phosphate industry wages have been traditionally higher than those paid by most other employers, it is expected that the per capita income for project employees will remain higher over time.

As the phosphate industry increases Hardee County activities, the importance of agriculture in county income will proportionally decline. Through reclamation practices, the total amount of land in agricultural production will be only slightly reduced at the termination of project operation. However, the removal of high value citrus production during mining and post-mining shift to lower value grazing will reduce agricultural income in the county to a certain extent.

Wage Differential. The wage differential between Farmland employees and other county employees will have an impact on income distribution, wage inflation, cost of doing business, and loss of employees to the phosphate industry in Hardee County. Table 10-21 presents estimated 1979 wage rates for Hardee County. Average wage rates for the Farmland project are $8.50/hr, which is 57.7 percent higher than average construction wages and county government wages, and nearly 2-1/2 times more than average service, agricultural, and clerical wages.

The differential between phosphate mining and other occupational wages will have several affects. In order to keep skilled employees in other occupations, local wages will inflate to be more competitive. While loss of employees to the CF Mining Corporation project was not as severe as projected, the Hardee County staff lost several personnel to the higher wages paid by CF Mining Corporation (Hardee County 1980a). The competition to retain employees will probably increase the cost of doing business in the trade, service, and construction sectors.

LAND USE

Land Use and Ownership

The Farmland Site. Farmland has designed their mining program and a reclamation plan and program to minimize the impacts of the project on site land use and maximize its suitability for post-mining uses. Table 10-22 lists the projected sequence of land use changes on the mine site that will occur as a result of the mine and reclamation plans, while Figure 10-7 shows the post-reclamation land uses. The land restored by the sand-clay mix method should be suitable for improved pasture. Reclamation will result in a 79.2 percent increase in the improved pasture acreage on the site (from 2416 to 4329 acres). Farmland has proposed establishing an uplands experimental area on reclaimed lands for the purpose of planting citrus, forage crops, commercial forest species, truck crops, and field crops to resolve questions on the suitability of restored lands for agriculture. This will include a 235-acre reclaimed area to be set aside for strip plantings of experimental crops, with planting estimated at 7 to 10 years after mining commences. No wide scale citrus plantings are planned to mitigate the loss of 1757 acres of citrus which will occur in mining.

Farmland has designed their mining plan to preserve some wetlands areas and restore others. Restoration, if successful, will result in a net increase (+54 acres) of freshwater marsh on the site. Freshwater swamps, considered more difficult to restore, will be reduced by 261 acres.

Farmland proposes to replant some 550 acres of reclaimed land with trees. The use of commercial species plantings such as Eucalyptus and slash pine will be examined by Farmland in an experimental area, but the majority of tree plantings will be made with transplants of native species from overburden removal and seedlings obtained from the Florida Forest Service.

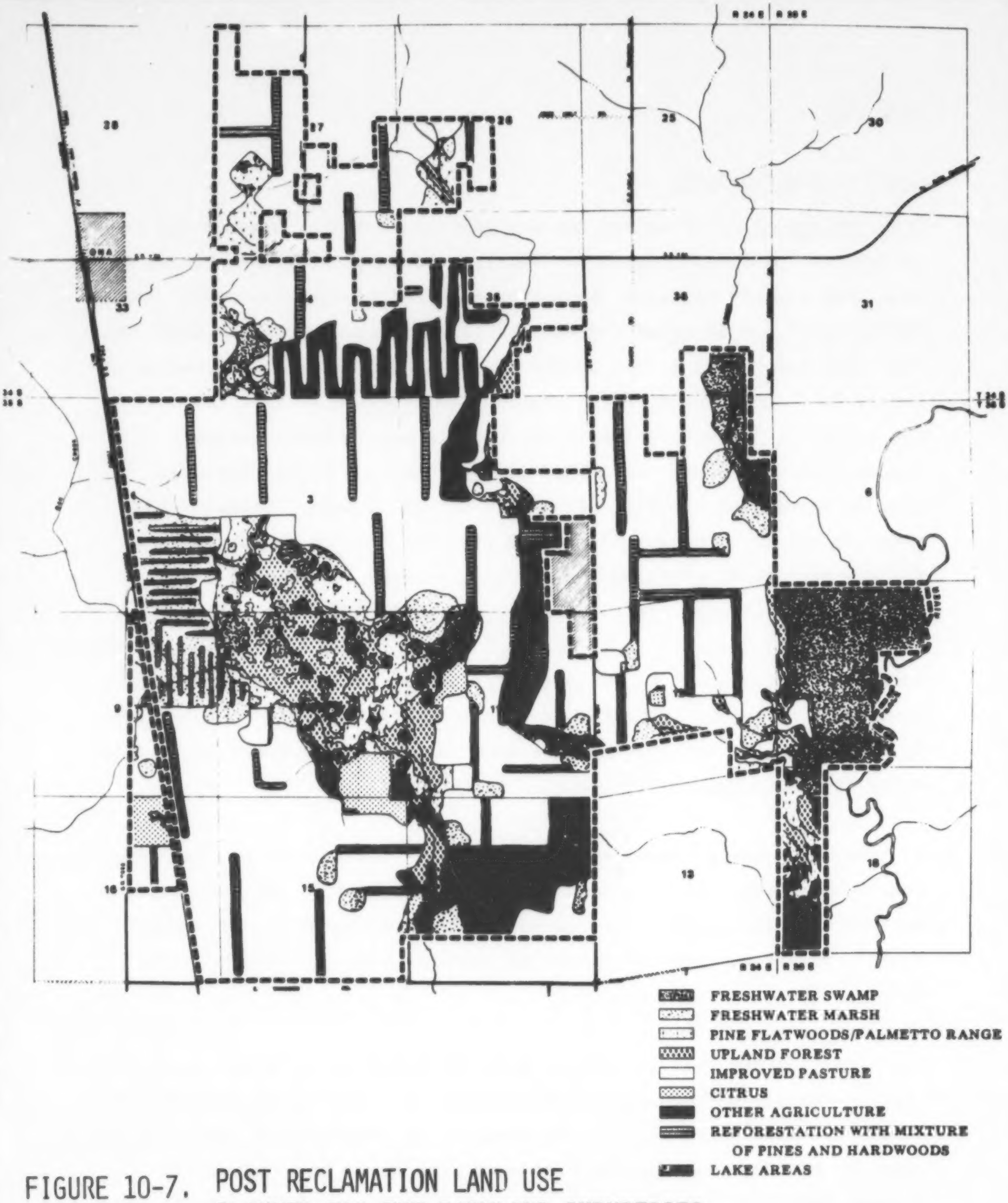

FIGURE 10-7. POST RECLAMATION LAND USE PLANNED FOR THE FARMLAND INDUSTRIES, INC. MINE SITE.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

Other potential post-mining uses include residential and light-industrial use. The tailings landfills will be reclaimed to provide sufficient structural stability for those uses. Emission of radiation from reclaimed areas, a significant problem in residential/industrial use of earlier mining reclamation, should be reduced by the sand-clay mix method of reclamation.

In addition to these changes in acreage and use, construction and mining activities will affect residential use on and near the Farmland site. Mining will not take place at those residences, but will affect their "residential" characteristics by the construction and operation activities (e.g., noise, dust levels, truck traffic) taking place in their immediate vicinity. This impact will occur over the project life of 26 to 30 years.

Recreation use of the site has not been documented; however, some hunting on Farmland property has been reported (Hardee County 1979b). As beneficial impacts, the project will create 235 acres of lakes that could be used for recreation purposes. In 1975, Hardee County had only 948 acres of rivers and lakes; the project will increase "water" by nearly 25 percent, which is of high potential recreation value in a county with only 0.24 percent surface water use available for recreation.

Hardee County. The loss of 1757 acres of citrus as a result of mining represents a loss of roughly 4 percent of Hardee County's bearing and nonbearing citrus acreage (Florida Crop and Livestock Reporting Service 1978). The potential relocation of direct and indirect/induced employment will create additional residential and commercial land use through a demand for housing and services. In the Central Florida Phosphate Industry Areawide Impact Assessment, EPA (1978) predicts a 67 percent increase in residential land use and a 62 percent increase in commercial and services use between 1975 and 2000. New residential, commercial, and industrial development is most likely to occur near the three incorporated urban areas in the county: Wauchula, Zolfo Springs, and Bowling Green.

Land Ownership. The impact on land ownership patterns depends on Farmland policies for land disposal after mining is completed. Land currently owned by Farmland, but leased to others for agricultural production or cattle pasture, will be withdrawn from those leases as required by the mining plan. Since this is Farmland's first mining operation, no company policy has been formed on use of reclaimed land. However, many phosphate companies retain ownership after reclamation but lease the land out for agricultural purposes, and Farmland will probably do likewise (Farmland 1980b).

Land Values

Farmland Site. The phosphate industry has traditionally had a profound impact on land values in central Florida. The presence of phosphate ore on the Farmland site has increased the value of the property compared to the value of the land for agricultural or other uses. Table 10-23 summarizes the 1979 property values per acre by land use category. The mine property has the highest value ($4000/acre), followed by residential ($3000/acre), citrus ($2500/acre), improved pasture ($1500/acre), pines/flatwood ($1000/acre), and mined out land ($500 to $800/acre) (Hardee County 1980c; Wauchula State Bank 1980b; Farmland 1979).

At current values, the Farmland mine site is worth about $31.2 million, more than twice its non-phosphate value of $11.0 million. The post-mining value of the mine site at $9.5 million will be 1.5 million less than the pre-mining non-phosphate value ($11.0 million), primarily due to the loss of citrus acreage. The post-mining value will also be $21.7 million less than the pre-mining phosphate value.

Land suitable for residential land is currently valued at $3000/acre. Through the potential relocation of 80 employees, some level of demand for new housing (that which exceeds the vacancy rate of suitable housing) will create additional residential growth. Residential land is currently projected to increase at an annual rate of 2.0 percent between

1975 and 1985, or approximately 70 acres a year. The Farmland project will contribute to increasing the value of that land which changes to residential use.

Compatibility and Conflicts with Existing Land Use Controls

Hardee County. All of the land on the Farmland site was originally zoned for agricultural use. However, Farmland has been granted a rezoning of the site to allow mining. Similar requests have been granted by the Hardee County Planning and Zoning Commission to CF Mining Corporation and Mississippi Chemical Corporation.

Farmland has submitted a "Master Plan" to Hardee County pursuant to the Hardee County Mining and Earth Moving Ordinance. Farmland has been granted variances to this ordinance which ordinarily prohibits mining in the 25-year floodplain and specifies a 500 foot setback from public roads. Mining is proposed by Farmland within the 25-year floodplain, and the reclamation plan proposes to use the area between 100 and 500 feet of the public roads for sand-clay disposal.

Since the proposed action represents a DRI as defined in Section 380.06, Florida Statutes, and Chapter 22F-2, Florida Administrative Code, Farmland prepared and filed (in June 1979) an Application for Development Approval (Farmland 1979). Following their review of the Farmland application, the Central Florida Regional Planning Council (1980) recommended in favor of the issuance of a Development Order for the mining operation with the following conditions:

- that there be only a single corridor across Oak Creek for all dragline crossings, pipelines, and access roads;
- that all fixed water control structures be removed from streambeds, lakes, or ponds after completing reclamation;
- that a scientifically defensible plan for the revegetation of sand-clay mix areas be approved before its inception;

- that the use of dry conveyor belts for matrix transport be investigated as an alternative to the proposed slurry matrix pumping;
- that the revegetation of reclaimed areas be done with native species; investigations of revegetation of reclaimed areas with non-native species can also be conducted, but only after a plan of study for such investigation has been reviewed and approved; and
- that Farmland apply to Hardee County for a determination if a variance to the Hardee County Mining and Earth Moving Ordinance is necessary in order to implement the proposed reclamation plan.

These recommendations have been forwarded to Hardee County pursuant to Section 380.06(11), Florida Statutes. A DRI public hearing for the Farmland project was held November 3-6, 1980 and a Development Order issued on December 4, 1980--30 days after the conclusion of the public hearing.

The Southwest Florida Water Management District (SWFWMD), with responsibility for water-related planning and consumption, administers consumptive use permits. SWFWMD has granted Farmland a consumptive use permit for the project.

Compatibility and Conflicts With Adjacent Land Uses

Some conflicts with nearby residential and agricultural use may arise from general mining activities--noise, increased truck traffic, water withdrawals, and air emissions. Mining activities and truck traffic associated with product movement will probably increase noise vibration levels that will be noticeable to nearby residents, particularly when mining takes place on those parcels closest to Ona. The effects of water withdrawals and air emissions on adjacent land areas are discussed in Sections 3.0, 6.0, and 7.0 of this document.

TRANSPORTATION SYSTEM

Traffic Levels

Hardee County Roads. Transportation impacts during construction and operation will result from three major types of activities: movement of heavy construction-related equipment to and from the Farmland site (short-term); movement of construction and operating employees between the site and residences (short-term and long-term), and the intermittent movement of products and supplies between the site and other locations (long-term).

Farmland has estimated that construction will generate 50 truck visits to the site per day or 100 one-way trips. Because this truck traffic is most likely to originate in service and construction areas of Hardee County, most of the traffic will be on SR 64 from Bradenton and from Zolfo Springs and on U.S. 17 from the Zolfo Springs junction to Polk County. The unimproved characteristics of the Fort Green-Ona Road are likely to deter frequent truck use of that road until improvements are made. During construction, employee and truck-related daily traffic will average 813 one-way trips and peak at 1225 one-way trips. Figure 10-8 shows the assumed distribution of daily construction-related traffic, compared with non-project traffic. The project will increase average daily traffic (ADT) levels by 4.5 percent on SR 64 west of the project site, by 29.3 percent on SR 64 east of the project site, and by 9.5 percent on SR 663 south of the site. Estimates of traffic generated assume that each employee during the construction and operational phases will generate 2.5 one-way vehicle trips per day, with an average of 285 construction employees and peak employment of 460.

Project-generated traffic during operation will average 858 vehicles per day. Figure 10-9 shows the assumed distribution of daily traffic during operations. Traffic would be increased by the following percentages over projected baseline levels: 5 percent for U.S. 17

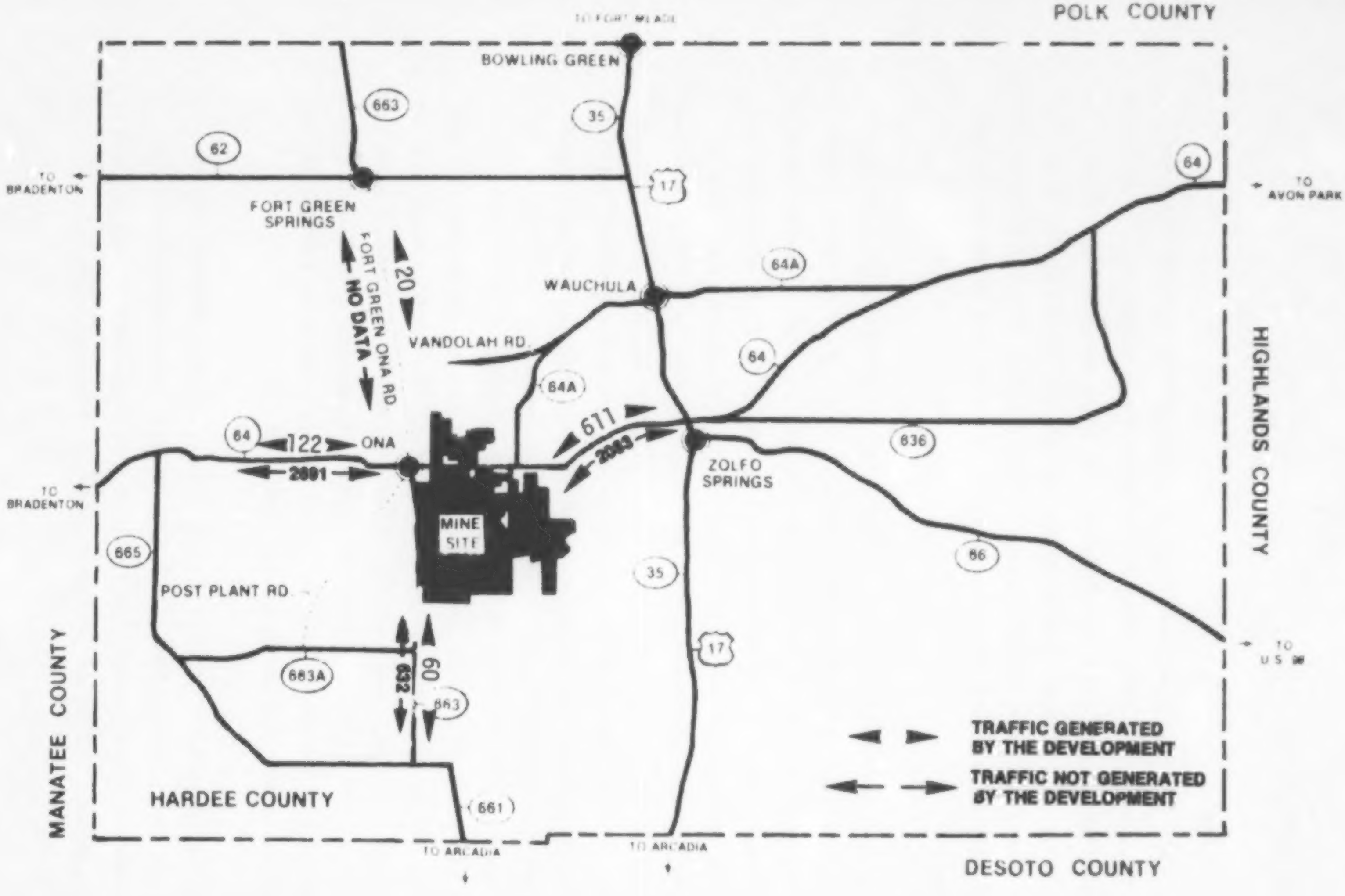

FIGURE 10-8. DISTRIBUTION OF AVERAGE DAILY TWO-WAY TRAFFIC DURING CONSTRUCTION ON ROADS IN THE FARMLAND INDUSTRIES, INC. SITE AREA.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

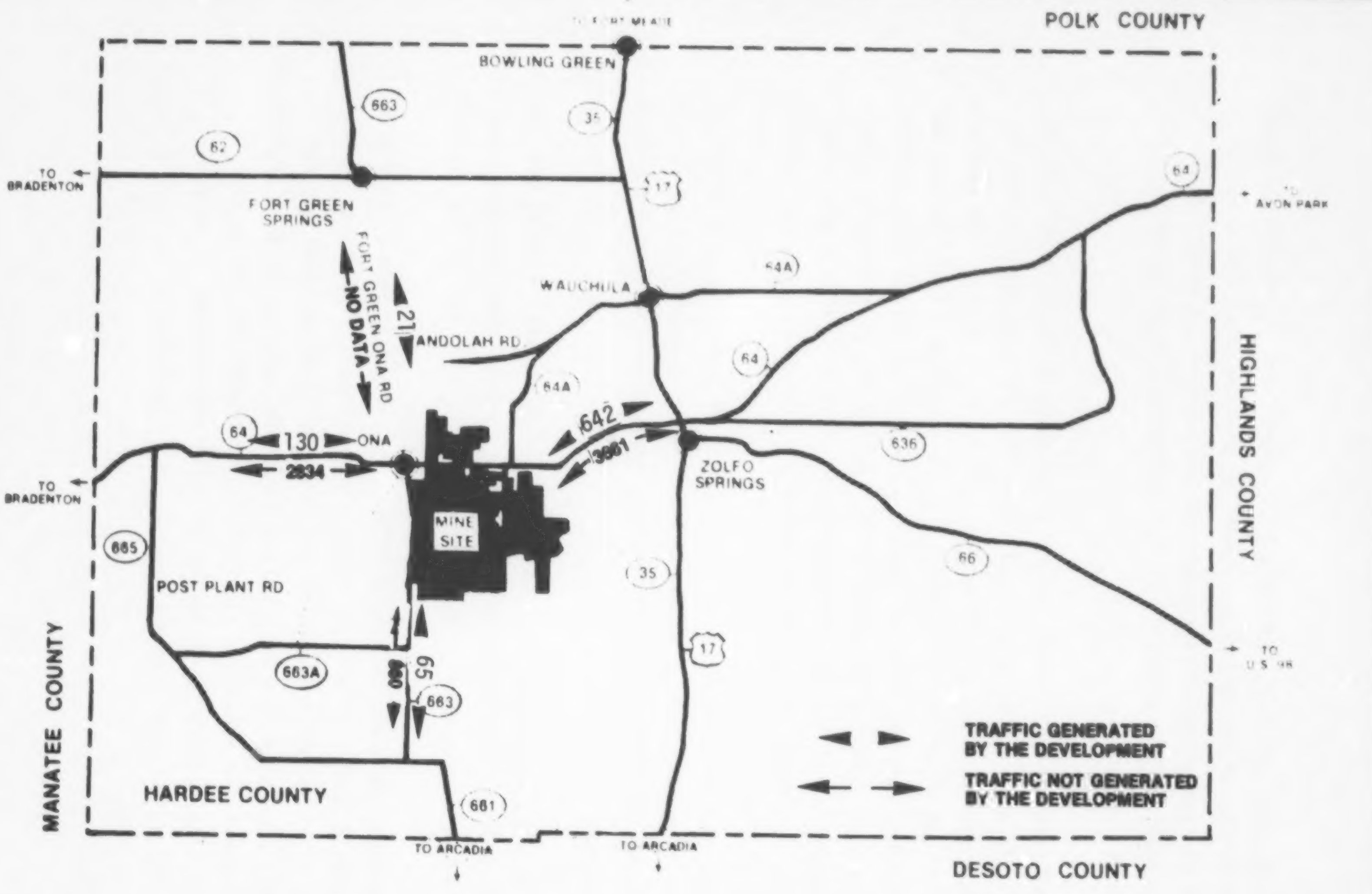

FIGURE 10-9. DISTRIBUTION OF AVERAGE DAILY TWO-WAY TRAFFIC DURING OPERATIONS ON ROADS IN THE FARMLAND INDUSTRIES, INC. SITE AREA.

SOURCE: FARMLAND INDUSTRIES, INC., DRI, JUNE 1979

between Wauchula and Zolfo Springs; 17.8 percent for SR 64 east of Ona; 4.6 percent for SR 64 west of Ona; and 7.6 percent on SR 663 south of Ona. SR 64 east of Ona will receive the most impact in terms of increased traffic, but the use of SR 64A to Wauchula might serve to reduce this impact.

Peak hour traffic generated by construction activities will occur between 7:00 a.m. and 8:00 a.m. and range from 11 vehicles per hour on the Fort Green-Ona Road to 788 vehicles per hour on SR 64. The incoming traffic to the site will affect U.S. 17, SR 64 (from both Bradenton and Zolfo Springs), SR 663, and the Fort Green-Ona Road. Peak hour traffic estimates are presented in Table 10-24. No current peak traffic level measurements are available for these roads. Project-related peak hour construction traffic will last for the 2 to 5 year construction period.

Peak hour operation traffic levels will be less than half that experienced during project construction and are expected to last for the operational life of the mine. Peak hour traffic projections for project operations are presented in Table 10-25.

Seaboard Coastline Railroad. Construction-related rail traffic will be intermittent and consist primarily of heavy construction equipment and equipment for operations activities transported from out of the region.

Farmland proposes to ship 2 million TPY of wet phosphate rock from the proposed mine. This would require an estimated 70 rail car trips per day. The Seaboard Coastline Railroad has estimated that the wet rock will be transported in a unit train. The increase in rail traffic will increase the frequency and duration of traffic delays at the railroad crossings on SR 64 and SR 62. The delay caused by an additional 70 rail cars should not exceed 2 to 3 minutes.

Other Traffic Levels. The project will have no direct impacts on Hardee County air transportation or public transportation systems. The population increase generated by employment relocation to the county will have a minor impact on these systems.

Transportation Facilities Costs

Capital Improvements and Facilities Upgrading. Increased traffic levels on roads in Hardee County and on the Seaboard Coastline Railroad will require improvements and increased maintenance of those facilities. Automobile and truck traffic will most likely require the paving of the Fort Green-Ona Road, at an estimated cost of $2.0 million (Adley Associates, Inc. 1979d). Other highway facility requirements consist of constructing turning lanes and placing a traffic light at the intersection of SR 64 and SR 663 at Ona, estimated to cost $60,000 (Adley Associates, Inc. 1979d). The railroad spur serving the beneficiation plant will make one crossing of SR 663, requiring a standard railroad crossing warning system. The Hardee County public finance implications of these transportation facilities requirements are discussed in the Public Finance section.

In addition to highway improvement requirements, Farmland will be constructing a 500-car parking area.

Use of the Seaboard Coastline Railroad for product shipment and facility supply will necessitate construction of a railroad spur and the availability of sufficient rolling stock. The railroad spur will be constructed from the proposed beneficiation plant to the Seaboard Coastline Railroad track, which runs along the western side of the Farmland site, adjacent to SR 663. The Seaboard Coastline Railroad has some rolling stock available and will purchase additional stock as necessary. No upgrading of existing track will be required (Seaboard Coastline Railroad 1980).

Maintenance Costs. Traffic level increases created by the project will have a small incremental effect on transportation maintenance costs (Hardee County 1979c). In the case of the CF Industries mine, construction did not increase road maintenance costs as most supplies came in by railroad (Hardee County 1980a). Assuming the repaving of 4 miles of road annually, maintenance costs would not exceed $100,000.

COMMUNITY SERVICES AND FACILITIES

Housing

The potential relocation of direct and indirect labor associated with the Farmland project will create a demand for 330 to 580 housing units in Hardee County. This estimate assumes that 80 Farmland employees and 250 to 500 indirect/induced employees will relocate in Hardee County and that each employee represents a household. Nearly all of this demand would be in Wauchula, Zolfo Springs, or Bowling Green, where the choice and quality of housing and levels of community services are greater than the rest of the county.

The estimated 1980 income levels by number of Farmland employees is shown in Table 10-20. Table 10-26 presents housing costs and required income levels for 1980 Hardee County housing prices (Wauchula State Bank 1980b). At 13.5 percent interest rate probably no more than 37 of the relocating employees could afford to purchase an older house priced at $30,000, and only 10 have the income necessary to purchase a new house priced at $48,000 or higher. The remaining 43 employees would be able to purchase a mobile home or rent housing. Of those 43, 17 would be limited by income to renting a housing unit.

Estimating total housing demand (i.e., due to direct and indirect employment) is more difficult. The average income levels of support industries relocating in Hardee County are likely to be greater than the county per capita income but less than phosphate company income levels.

Assuming that the income levels are proportionally similar to the phosphate industry, housing demand under high and low relocation scenarios is 43 to 76 new single family units, 113 to 199 older single family units, 107 to 187 mobile homes, and 71 to 123 rental units. If income levels are lower than phosphate industry income, demand for older housing, mobile homes, and rental units is likely to be greater than these figures.

Schools

The population increase in Hardee County attributable to direct and indirect employment relocation has been estimated to be 980 to 1580 for the low and high relocation scenarios (see Table 10-19). Using the ratio between population and school enrollment in 1976 (3.99:1), the Farmland project will generate an additional enrollment of 246 to 396 students. Current enrollment in Hardee County schools is estimated at 4500 students. The capacity will be raised to 5600 once construction of the new high school is finished. Thus, the school district will have the capacity for an additional 1100 students. The annual increase in enrollment between 1976 and 1980 has been 1.8 percent. At this rate of growth, student enrollment when project operations begin in 1983 is projected to be 4750, an increase of 250 students. This increase combined with the maximum projected Farmland induced increase totals 655 students, which is well within the school district's extra capacity for 1100 students. Unless other proposed phosphate operations commence prior to the Farmland project, the Hardee County School District has the capacity to absorb project-generated enrollment.

The public finance implications of the project on the school district are discussed in the Public Finance section.

Fire Protection

The mine (beneficiation plant complex) will have a complete fire protection system, and plant employees will be responsible for the operation of fire fighting equipment. Should a major conflagration occur, assistance from one or more of the municipal fire departments may be necessary. Some controlled burning to maintain project-site rangelands may be scheduled periodically. Burning permits are required by Hardee County, and proper precautions will be followed (e.g., favorable meteorological conditions, use of fire breaks). If any fire onsite becomes a threat to property, assistance from the State Forest Service and municipal fire departments will be requested.

The population increase of 980 to 1580 persons generated by employment relocation will decrease per capita fire protection in Hardee County by 5 to 8 percent. Since relocating population is most likely to move to the urban areas (Wauchula, Bowling Green, and Zolfo Springs) where housing and cultural/service communities are available, the project will not increase demands on the already inadequate service to rural areas. Wauchula, with its professional fire department, will probably receive the most demand but is the best equipped to meet it. The increased service demand on the volunteer departments of Bowling Green and Zolfo Springs might increase the need for additional personnel and new fire fighting equipment (Town of Wauchula 1979). In 1976, Hardee County had the highest ratio of firefighters to population in municipal areas of any of the seven counties in the Central Florida Planning Region. This ratio was 7.65 per 1000 population (EPA 1978). To maintain that same level of service, an additional 7 to 12 fire fighters would be needed (depending on population scenario).

Medical and Health Service

The population increase generated by the project will increase the demand on medical and health services in the county by 980 to 1580 persons. In 1976, the ratio of hospital beds per 1000 population was 3.33, the lowest in the seven county Central Florida Planning Region (EPA 1978). The same was true of medical doctors per 1000 population

(0.76). To maintain 1976 levels of county-wide health care, an additional three to six hospital beds and at least one additional medical doctor will be needed (depending on population scenario).

The project will also have a beneficial impact on health care, one that will partially offset the increased demand described above. Because of the higher income levels and company medical insurance coverage of employees, medical expenses incurred by employees will be covered. This will provide a more stable base for medical facilities serving the area.

PUBLIC FINANCE

Hardee County

Direct Revenues Generated by the Project. The property tax levies for Hardee County, including county-wide and municipal levies, are presented in the Public Finance section of 10.1. The county and municipalities apply the same tax levies to real and personal property. Since the project site lies in the unincorporated area of the county, the site and capital improvements can only be taxed by the county.

Table 10-27 presents the estimated value of land and capital improvements for the Farmland project (Farmland 1981), and the property tax revenue generated by the project. With a combined property and capital improvement assessed value of 86.2 million, approximately $900,000 in Hardee County tax revenues will be generated annually at current mill rates. This represents a 16 percent increase in the 1979 assessed value and revenue generated in Hardee County. Of the $900,000 in revenue, 31.2 percent is allocated to the general county fund, 66.4 percent to the school district, and 2.4 percent to the Southwest Florida Water Management District and the Peace River Basin. The actual revenue will be slightly less than these figures because of two exemptions for assessable property that Farmland can declare under state law. Pollution control devices are assessed at 10 percent of just value, and any inventory of wet phosphate rock destined to be shipped to another in-state location for processing is assessed at 1 percent of its just value.

Expenditures Required by the Project. Three types of public expenditures will be generated by the project: capital improvements; public facilities operations and maintenance; and increased administration and services (primarily personnel costs) required by the project-related population increase. Table 10-28 shows the expenditures required by the project. One-time direct expenditures will total $2.43 million; annual expenditures are estimated to be $701,000 to $928,000, depending on the increase in school enrollment.

The direct capital improvements required by the project are the paving of the Fort Green-Ona Road, installation of traffic signals and construction of turning lanes at the intersection of SR 64 and SR 663 in Ona, and the placement of a railroad crossing for the railroad spur from the Seaboard Coastline Railroad track to where the mine crosses SR 663. The 1980 costs for these projects total about $2.36 million.

The population increase generated by relocating direct and indirect employment will increase Hardee County School District expenditures by increasing enrollment by 231 to 405 students. The average annual expenditure per pupil was $1303 for the 1978-79 fiscal year (Hardee County 1979). This figure represents general operating expenditures but does not include capital outlays; however, since excess capacity with construction of the new high school is estimated to be sufficient to meet natural growth and Farmland enrollment, no significant capital outlays would be required by the project. The 1979 level of expenditure required for an additional 231 to 405 students is $300,993 to $527,715.

There are two indirect capital improvement expenditures required to maintain levels of community service (or prevent deterioration of service) in the face of increased county and municipal population generated by the Farmland project. The municipalities of Bowling Green and Zolfo Springs each need a new or upgraded fire truck to maintain current levels of fire protection, and the Farmland project will increase this need, particularly if back-up fire fighting equipment is needed. The cost for a new truck (900-1200 gallon tank) is estimated at $35,000 (Town of Wauchula 1979), and capital expenditures for two fire trucks total $70,000.

Operation and maintenance costs of local highways serving the mine will increase because of the increase in traffic on these highways. The most likely maintenance cost to be incurred would be increased frequency of resurfacing SR 64, SR 63, and the Fort Green-Ona Road (once paved). Using current road resurfacing costs (recently estimated at $25,000/mile by Adley Associates, Inc. [1979d]), the estimated annual expenditure for this maintenance is estimated to be on the order of $100,000.

Annual expenditures for governmental administration and community services, which are primarily personnel expenditures, are estimated to be $300,000. This expenditure is an estimate of additional hires needed to maintain levels of governmental administration and community services.

Revenue/Expenditure Timing and Jurisdictional Mismatches. Public finance impacts resulting from timing of expenditures and revenue availability are expected to be minor. The greatest proportion of revenues and expenditures will be generated during the operations phase of the project, primarily through capital improvement revenues and expenditures due to population increases (education, community services). In Hardee County, property is assessed in January and billed in November, with taxes due by March 31 of the following year. However, if the capital improvements are substantially complete by January, they are assessed at full value. Coupled with the probable lag in employment relocation, the increase in revenue should cover increases in expenditures in a timely fashion. In general, the same situation will exist with secondary revenues and expenditures generated in Wauchula, Zolfo Springs, and Bowling Green.

A temporary inequity between revenues and expenditures may result from highway capital improvements. Construction related traffic may require installation of the traffic signal and turning lanes at the intersection of SR 64 and SR 663, and possibly paving the Fort Green-Ona Road, before operating revenues are sufficient to meet those expenditures. Given the lag time in implementing highway improvements and the low priority assigned by Hardee County, this is unlikely.

Jurisdictional Mismatches. Some minor jurisdictional mismatches will occur between Hardee County and the municipalities of Wauchula, Zolfo Springs, and Bowling Green. The county will collect revenue from project property and capital improvements and incur expenditures for capital improvements, education, highway maintenance, and some personnel costs. The municipalities will collect revenue on the personal and real property of employees locating within their boundaries and from service charges, while incurring expenditures for some capital improvements (fire trucks) and personnel. The per capita revenues from service charges and sales tax revenue distributed to the municipalities should be sufficient to cover required expenditures, with the exception of capital improvement expenditures.

Severence Taxes

The Farmland project will generate revenue to the State of Florida through the levy of a severence tax on the phosphate rock mined. Under Chapter 211, Part II of the Florida statutes, wet phosphate rock is taxed at 10 percent of its value at the point of severence--at a beneficiation plant. The state bases its tax on the average sale price per ton, and local and *ad valorem* taxes are credited against the value subject to severence tax if the phosphate company has a reclamation plan on file with the State Department of Natural Resources. Currently, 75 percent of severence tax revenue is credited to the General Revenue Fund of the state; the remaining 25 percent is credited to the Land Reclamation Trust Fund. The creation and operation of the Florida Institute of Phosphate Research will be funded from severence tax revenues, requiring 25 percent of those revenues beginning in 1980.

The 1978 average value per ton of phosphate rock was $12.09 for a statewide total of 44,296,000 tons (Florida Department of Revenue 1979). Farmland proposes to produce 2,000,000 tons annually. Using the 1978 average value per ton, the Farmland project would generate $2,418,000 of severence tax revenue annually. Assuming, conservatively, that the 10 percent Hardee County *ad valorem* assessment applies to the entire 2,000,000 tons, approximatley $25,000 would be credited against the severence tax, resulting in $2,393,000 of adjusted severence tax revenue in 1978 dollars. This represents a 4.5 percent increase in severence tax revenue.

CULTURAL RESOURCES

Pursuant to Section 106 of the National Historic Preservation Act, EPA consulted with the State Historic Preservation Officer's office to obtain an evaluation of the cultural resource impacts of the Farmland project. Based on the results of surveys conducted on the Farmland site and a review of the Florida Master Site File, this state agency is of the opinion that the Farmland mine is unlikely to affect any archaeological or historic sites listed, or eligible for listing, on the National Register of Historic Places, or otherwise of national, state or local significance (Percy 1980).

VISUAL RESOURCES

In Section 10.2 (Visual Resources) each feature of the existing physical environment (landform, vegetation, structures) was described in terms of form, line, color, and texture. The proposed project would create changes in these basic landscape features. The resulting changes are described in terms of form, line, color, and texture and compared with the existing environmental description to determine conflicts or contrasts. Contrasts that are not harmonious with the existing landscape features would become negative visual resource impacts. Other contrasts would become beneficial impacts if the visual quality of the landscape improved. The analysis of human perception of the physical environment is used to determine the relative significance of the visual impacts.

Construction

Construction impact assessment for visual resources only considers the completed results of initial construction such as finished buildings, access roads, settling areas, grading, and retention dams. Actual construction activities may be unsightly at times, but this disturbance occurs over a shorter time period and is less significant than the total impact of the completed project elements before operation begins. This discussion will be limited to the beneficiation plant complex and settling areas. Mining activities are included in the operations discussion.

Beneficiation plant complex construction would substantially change the landform in order to create the waste disposal recirculation system that includes canals, clean water pond, and retention dams. The retention dam heights would be as much as 41 feet above the natural grade, which is relatively flat, and have slopes between 20 and 40 percent. The height, slope, and configuration of these dams are not characteristic of this rural area. This landform contrast would be a negative visual impact and would be particularly perceptible to motorists on SR 663 and SR 64.

Large rectangular areas of vegetation would be cleared to construct the beneficiation plant and settling areas. The existing random vegetation patterns and lines would be replaced with sharp, rigid lines that would direct views from SR 663 and SR 64 toward the plant structures. The resulting contrast would be a moderate negative visual impact. Some of this harsh contrast would be reduced once the dams were revegetated for stabilization.

Beneficiation plant structures would create strong visual contrasts in this rural setting. The texture, color, height, and form of these industrial structures are unlike nearby rural structures and do not blend into the surrounding area. The contrasts represent a strong negative visual impact. Initially, the plant would be partially obscured from view by existing vegetation but as mining progresses visibility of the plant would increase. Views from East Whidden Road would be the least affected because the preserved areas south of the plant would block views of most of the structures.

Operation

The landforms of the mine site would be totally transformed during mining operation except in most preserved areas. Open pits, water ponds, spoil piles, and retention dams all strongly contrast with the existing conditions. Portions of stream channels would be totally relocated. Retention dams and spoil piles along roadsides would be the most easily detectable landform change. The buffer along the roadways is not adequately vegetated to provide significant screening. Parcels not owned by Farmland would screen some views, especially along SR 661. Most mining, however, would occur adjacent to the roadways. The negative visual impact to the landform would be the greatest during the middle of the mine's life and then decline as restoration results become noticeable.

Mining operations would remove vegetation gradually but there would be sharply defined (mechanical) lines and abrupt color changes between existing vegetation and the mining area. These contrasts will be strongest near the preserved areas where vegetation is dense, tall, and irregularly shaped. The contrast would be less distinct in the remaining areas that are primarily citrus and pasture. Strong line contrasts would also be created where vegetation is removed in the preserved areas for dragline crossings. As mining progresses and larger areas become void of vegetation the contrasts would become more noticeable. The reclamation/revegetation process (discussed below) would take several years to reduce the majority of visual contrasts. These contrasts caused by changes in the vegetation patterns would be a strong negative visual impact.

Although it is not an actual, fixed structure, the dragline would be large enough to create a noticeable contrasting profile in the relatively flat terrain.

Post-Reclamation and Abandonment

After reclamation the landforms would be different from the existing conditions. The final topography would be defined as a series of plateaus rather than flat land and would be higher in elevation than the surrounding areas. Elevation differences would be most noticeable from the roadways. The form of the topography would appear manipulated when compared to the existing and surrounding terrain. Former settling areas would create a stronger contrast to the surrounding terrain than other site areas because of a greater increase in elevation. Wetland and lake areas would have strong line and form contrasts because they appear manipulated and unnatural when compared to similar natural areas. Revegetation would reduce or obscure some landform contrasts in the wetland and lake areas but it would take several years to do so.

Revegetation efforts for the post-reclamation plan would totally change the quality of the existing random and irregular mixture of open space and natural areas. Strong contrasts in form and line would occur where reforestation strips meet preserved areas. These strips appear utilitarian, repetitious, and rigid when compared to the existing and surrounding vegetation patterns. The proposed vegetation patterns (land uses) would not blend harmoniously with the preserved areas causing preserved areas to appear isolated. Revegetation would not begin until approximately 7 years after mining is initiated and the success of these efforts is uncertain (experimental in some areas). Therefore, the vegetation contrasts would exist throughout the project life and years after mining ceases. The proposed vegetation of the post-reclamation plan when fully matured would still create negative visual impacts.

Removal of all unnecessary buildings from the mine site after project completion would restore the agricultural scale of the area and improve the visual quality.

Summary

Construction, operation, and reclamation of the mine site would create a variety of moderate to strong visual impacts. Initially, the mining sequence would isolate the impacts and allow some to be screened from view. As mining progresses and reclamation lags behind, impacts would become cumulative and would be noticeable to some degree from any of the bordering roadways. However, the human perception information in Section 10.1 indicates that on a regional basis few people would see the mining development. Locally, the mining development would totally change the existing rural character. Reclamation and revegetation would eventually restore most of the rural visual quality, but total restoration would take 24 years to complete. Total revegetation to similar existing conditions would take longer. The visual impacts to the rural quality of this site would be repeated with additional mining proposals nearby creating areawide cumulative impact.

10.2.2 THE NO ACTION ALTERNATIVE

The socioeconomic impacts of the no action alternative would, in effect, be the unrealized potential economic benefits which are discussed within the environmental consequences of the proposed action alternative. Some of the economic burdens which the project will create (e.g., increased maintenance costs for highways) are likely to be incurred with or without the Farmland project as other mines become permitted in the area. On the other hand, other more population dependent impacts (e.g, increased school enrollment, increased demand for fire protection, etc.) will not be as severe as with the project.

Under the no action alternative, orange groves on the Farmland site would likely continue to produce over the life of the proposed mine. Citrus and pasture now comprise about 53 percent of the total Hardee County land use and account for the economic base of Hardee County (Hardee County 1980b). Farmland's reclamation plan will increase the pasture acreage in the county, but result in a net loss of citrus acreage. While this loss in itself may not significantly alter the county's economic base, other grove owners in the vicinity of the site (Abrons 1980) have expressed concern about the availability and cost of support services for their groves as phosphate owned groves around them are cleared and replaced by pasture. Continued production of the Farmland groves under the no action alternative would provide a greater demand for support services in the area, a benefit to adjacent grove owners.

An additional advantage of the no action alternative would be the preservation of the visual resources of the Farmland site. Should mining activities occur in Hardee County over the next 20 to 30 years as they have in neighboring Polk County, the occurrence of land in its undisturbed natural state can be expected to decrease.

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Table 10-1. POPULATION OF HARDEE COUNTY JURISDICTIONS

Area	April 1, 1970 Census	November 1976 Special Census	July 1, 1978 Estimate
HARDEE County	14,889	16,571	17,827
Bowling Green	1,357	1,573	1,620
Wauchula	3,007	2,892	3,330
Zolfo Springs	1,117	1,251	1,253
Unincorporated	9,408	10,855	11,624

Source: University of Florida 1979a & 1979b.

Table 10-2. POPULATION AND GROWTH RATES FOR HARDEE COUNTY, THE REGION, AND THE STATE

Area	April 1, 1970 Census	July 1, 1978 Estimate	Annual Average Growth Rate
Counties			
HARDEE	14,889	17,827	2.3%
Charlotte	27,559	50,219	7.8
DeSoto	13,060	18,396	4.4
Hillsborough	490,265	615,844	2.9
Manatee	97,115	135,415	4.2
Polk	228,515	284,388	2.8
Sarasota	120,413	183,426	5.4
REGION TOTAL	990,523	1,305,515	3.5
STATE OF FLORIDA	6,791,418	8,966,395	3.5

Sources: University of Florida 1979a.

Table 10-3. COMPONENTS OF POPULATION CHANGE FOR HARDEE COUNTY, THE REGION, AND THE STATE

Area	Components of Population Change 1970-1978		Percent of Change Due to --	
	Natural Increase	Net Migration	Natural Increase	Net Migration
Counties				
HARDEE	1,386	1,552	47%	53%
Charlotte	-2,772	25,432	-12	112
DeSoto	624	4,712	12	88
Hillsborough	28,928	96,651	23	77
Manatee	-3,844	42,144	-10	110
Polk	12,258	43,615	22	78
Sarasota	-8,252	71,265	-13	113
REGION TOTAL	28,328	285,371	9	91
STATE OF FLORIDA	199,194	1,975,783	9	91

Source: University of Florida 1979a.

Table 10-4. AGE DISTRIBUTIONS OF HARDEE COUNTY AND FLORIDA

Area	Age	Age Distributions (percentages) 1960	1970	1977
HARDEE County	0-14	31.2	31.6	31.4
	15-44	38.2	38.4	38.8
	45-64	20.3	20.0	18.8
	65+	10.3	9.9	10.9
State of Florida	0-14	29.6	25.8	21.5
	15-44	38.6	38.1	39.2
	45-64	20.6	21.6	22.0
	65+	11.2	14.5	17.3

Source: University of Florida 1979a.

Table 10-5. LABOR FORCE AND UNEMPLOYMENT ESTIMATES, HARDEE COUNTY

Year/Month	Labor Force	Unemployment	Unemployment Rate
1976			
Annual Average	6923	388	5.6
1977			
Annual Average	7523	504	6.7
1978			
January	8954	520	5.8
February	9196	479	5.2
March	8744	479	5.5
April	8952	521	5.8
May	9706	516	5.3
June	9519	552	5.8
July	9447	755	8.0
August	9311	760	8.2
September	9194	893	9.7
October	9210	804	8.7
November	9090	668	7.3
December	9956	859	6.6
Average	9273	634	6.8
1979			
January	10082	788	7.8
February	10297	542	5.3
March	9139	551	6.0
April	9080	409	4.5
May	8999	355	3.9
June	9451	738	7.8
July	8838	886	10.0
August	8842	940	10.6

Source: Florida Department of Labor and Employment Security 1979a).

Table 10-6. **CHARACTERISTICS OF UNEMPLOYMENT COMPENSATION RECIPIENTS--JULY 1979**

County of Residence	Total Recipients July 1979	Percent Female	Percent Non-White	Percent Hispanic	Industry Division				
					Farming	Mining	Construction	Manufacturing	All Other
HARDEE	202	48.0	18.8	19.8	73	-	1	70	58
Charlotte	129	55.8	3.9	-	7	-	12	4	106
DeSoto	96	45.8	40.6	1.0	66	-	3	10	17
Hillsborough	3476	46.3	16.5	7.7	198	1	248	993	2036
Manatee	549	53.9	14.6	-	116	-	41	102	290
Polk	4762	58.8	23.9	0.4	1757	4	92	1874	1035
Sarasota	543	52.5	2.6	0.2	40	-	29	53	421
TOTAL	9757	NA	NA	NA	2257	5	426	3106	3963

Source: Florida Department of Labor and Employment Security 1979 e.

Table 10-7. PERSONS BELOW THE POVERTY LEVEL, 1970 AND 1980

Category	Planning District VII 1970	1980
Total Population	295,911	406,700
Below Poverty Level	60,760	92,118
Percent Below Poverty Level	20.5	22.7
White Population	244,433	338,131
Below Poverty Level	37,484	55,284
Percent Below Poverty Level	15.3	16.4
Black Population	50,584	67,309
Below Poverty Level	22,978	32,517
Percent Below Poverty Level	45.4	48.3

Source: Projections by Labor Market Analyst, Florida State Employment Service based on 1970 Census and recent trends. Reported in Florida Department of Labor and Employment Security 1979 d.

Table 10-8. GENERALIZED LAND USE, HARDEE COUNTY, 1975

Applicable LUDA Levels Level I/Level II	Area Hectares	 (Acres)	Percent of County
Urban or Built Up			
Residential	1,419.3	(3,507)	0.87
Commercial and Services	118.6	(293)	0.07
Industrial	67.2	(166)	0.04
Transportation, communications, and utilities	229.1	(566)	0.14
Industrial and commercial complexes	-	-	-
Mixed urban or built-up areas	-	-	-
Other urban or built-up areas	27.5	(68)	0.02
Agricultural Land			
Cropland and pasture	41,672.4	(102,971)	25.54
Orchards, groves, vineyards, nurseries, and ornamental horticultural areas	27,972.9	(69,120)	17.14
Other agricultural land	-	-	-
Rangeland	58,569.4	(144,723)	35.89
Forest Land	4,572.7	(11,299)	2.80
Water	383.7	(948)	0.24
Wetland	28,091.0	(69,412)	17.22
Barren Land			
Strip mines, quarries, and gravel pits	-	-	-
Other barren land	51.8	(128)	0.03
COUNTY TOTAL	163,175.6	403,201	100

Source: EPA (1978).

Table 10-9. HARDEE COUNTY ESTIMATED CITRUS PRODUCTION (1,000 Boxes)

	Season				
Type	1974-75	1975-76	1976-77	1977-78	1978-79
Oranges	11,576	12,073	12,877	12,584	13,277
Grapefruit	239	280	353	358	390
Other	402	515	498	602	677
COUNTY TOTAL	12,217	12,868	13,728	13,554	14,344
STATE TOTAL	232,950	249,480	254,500	234,620	230,190

Source: Florida Crop and Livestock Reporting Service (1979).

Table 10-10. CURRENT LAND USE AND COVER CLASSIFICATION FOR THE PROPOSED SITE.

Classification	Acres	Percent
213 - Improved Pasture	2416	30.1
230 - Citrus	1917	24.5
262 - Other Agriculture	153	1.9
411 - Pine Flatwoods/Palmetto Range	937	12.0
414 & 431 - Other Coniferous and Mixed Forest	373	4.8
422 - Other Hardwood Forest	417	5.3
621 - Freshwater Swamp	1205	15.4
641 - Freshwater Marsh	392	5.0
TOTAL	7810	

Source: Farmland Industries, Inc. 1979.

Table 10-11. YEAR-ROUND HOUSING INVENTORY IN HARDEE COUNTY, 1978

Area	Housing Units By Type			
	Single-Family	Mobile Home	Multi-Family	Total
Unincorporated Areas (as of 10-31-78)				
Wauchula Suburban	368	79	56	503
Magnolia Manor Area	300	57	5	362
Wauchula Hills	245	111	13	369
Bowling Green So.	84	56	0	140
Fort Green Springs	42	23	0	65
Limestone	30	15	0	45
Ona	75	13	0	88
Rural Balance	1,684	757	71	2,512
SUBTOTAL	2,828	1,111	145	4,084
Incorporated Areas				
Wauchula				
Bowling Green				
Zolfo Springs				
SUBTOTAL				
HARDEE COUNTY TOTAL				

Source: Adley Associates, Inc. (1979b).

Table 10-13. REVENUE SOURCES FOR HARDEE COUNTY JURISDICTIONS, FISCAL YEAR 1978

Category	Hardee County	Wauchula	Bowling Green	Zolfo Springs
Population	17,827	3330	1620	1253
Revenue Sources ($1000)				
Property Taxes	1072	84	37	25
Franchise & Utility Taxes	0	131	49	35
Licenses & Permits	89	7	6	2
Intergov'tal Transfers	1884	748	445	100
Services Charges	192	2258	120	45
Fines & Forfeitures	122	23	16	8
Misc.	40	188	23	17
TOTAL REVENUE	3399	3439	695	232

Source: Florida Department of Banking & Finance (1979).

Table 10-12. HARDEE COUNTY SCHOOL DISTRICT FACILITIES AND ENROLLMENT

Facility	Maximum Capacity	Current Enrollment 1/22/79	Current Enrollment 10/8/79
Elementary Schools			
N. Wauchula Elem.	700	739	656
Wauchula Elem.	800	765	672
Bowling Green Elem.	650	636	517
Zolfo Elem.	650	603	512
Secondary Schools			
Jr. High School	2000	744	633
Sr. High School	2000	1036	1066
New Sr. High School	(800+)	-	-
TOTALS	4800	4523	4056

Source: Hardee County School Superintendent (1979).

Table 10-14. HARDEE COUNTY SCHOOL DISTRICT REVENUES AND EXPENDITURES, FISCAL YEARS 1979 AND 1980

Category	1978-79 Budgeted	1979-80 Budgeted
	($1000)	
REVENUES		
General Fund		
State Sources	3681.3	3244.8
Local Sources		
Property Taxes	1733.2	3282.3
Other	90.0	65.0
Beginning Balance	619.2	845.9
TOTAL	6123.7	7437.9
Debt Service Funds		
State Sources	52.2	244.4
Local Sources		
Property Taxes	135.4	256.4
Beginning Balance	228.2	481.4
TOTAL	415.7	982.2
Capital Projects Funds		
State Sources		
CO & DS	93.2	91.9
Public Education Bond	223.9	1603.9
Other	0.0	390.0
Local Sources		
From General Fund	187.4	641.1
Beginning Balance	890.4	3596.5
TOTAL	1395.0	6323.3
EXPENDITURES		
General Fund		
Instruction	3184.6	3487.0
Support Services	2208.5	2440.0
Transfers		
Capital Projects Funds	187.4	641.1
Special Revenue Funds	50.0	100.0
Ending Balances	437.5	749.8
TOTAL	6123.7	7437.9
Debt Service Funds		
Debt Service	167.9	333.3
Ending Balance	247.9	648.9
TOTAL	415.7	982.2
Capital Projects Funds		
Capital Expenditures	40.6	5954.3
Ending Balance	1354.4	369.1
TOTAL	1395.0	6323.3

Note: Does not include the Food Service or Other Special Revenue Funds which are self-supporting or minor, respectively.

Source: Hardee County School District (1978;1979).

Table 10-15. PROPERTY TAX BASE FOR HARDEE COUNTY JURISDICTIONS

Category & Year	Hardee County	Wauchula	Bowling Green	Zolfo Springs
Total Taxable Value ($million)				
1979	539.85	NA	NA	NA
1978	451.53	28.55	7.72	6.41
1977	321.60	21.49	5.72	5.23
1976	252.04	NA	NA	NA
1975	163.22	NA	NA	NA

Source: Florida Department of Revenue, Ad Valorem Tax Division (1979)

Table 10-16. PROPERTY TAX LEVIES FOR HARDEE COUNTY

Category	Year 1976	1977	1978	1979
County-Wide				
Board of County Commissioners	4.662	3.808	3.696	3.248
Board of Public Instruction (DSF)	6.300	6.400	6.400	6.400
Board of Public Instruction (I&S)	0.500	0.500	0.500	0.500
SWFWMD	0.190	0.100	0.100	0.080
Peace River Basin	0.210	0.230	0.190	0.170
County-wide TOTAL	11.862	11.038	10.886	10.398
Municipal				
Wauchula	3.654	3.522	2.200	2.200
Bowling Green	7.091	6.875	7.248	6.031
Zolfo Springs	5.288	5.063	4.294	4.292

Source: Hardee County Clerk (1979).

Table 10-17. EXPENDITURES BY CATEGORY FOR HARDEE COUNTY JURISDICTIONS, FISCAL YEAR 1978

Category	Hardee County	Wauchula	Bowling Green	Zolfo Springs
Expenditures by Category ($1000)				
General Government	938	171	125	68
Public Safety	811	257	74	50
Law Enforcement	(547)	(146)	(68)	(46)
Fire Protection	(42)	(106)	(4)	(4)
Other	(222)	(5)	(2)	(0)
Public Works	469	2161	457	135
Water	(0)	(98)	} (375)	(62)
Sewer	(0)	(198)		(0)
Solid Waste	(2)	(99)	(27)	(26)
Other	(467)	(1766)	(55)	(47)
Transportation	450	578	0	7
Road & Streets	(450)	(48)	(0)	(7)
Airports	(0)	(529)	(0)	(0)
Human Services	612	116	30	0
Health Care	(24)	(0)	(0)	(0)
Welfare	(42)	(0)	(0)	(0)
Library	(2)	(2)	(0)	(0)
Recreation	(79)	(84)	(24)	(0)
Economic Development	(464)	(30)	(6)	(0)
TOTAL EXPENDITURES	3279	3283	686	259

Source: Florida Department of Banking & Finance (1979).

Table 10-18. **ESTIMATED DIRECT EMPLOYMENT IN HARDEE COUNTY FOR THE PROPOSED FARMLAND** INDUSTRIES, INC. PROPERTY.

Component & Phase	Year(s) 1981	1982	1983	1984-2003
Construction				
Annual Average	228	228	228	-
Peak	-	460	-	-
Operation	-	-	325	325

Source: Farmland Industries, Inc. 1979.

Table 10-19. DIRECT AND SECONDARY EMPLOYMENT AND POPULATION ASSOCIATED WITH THE FARMLAND MINING PROJECT.

Phase/ Scenario	Direct Employment[a]	Percent Relocating in Hardee County	Secondary Employment[b]	Percent Relocating in Hardee Co.	Total Population Added By 1985	
					Regional	Hardee County
CONSTRUCTION						
Mine	228	0%	702	10%	1867	70
OPERATION						
High Scenario						
Mine	325	25%	2000	25%	864	1546
Low Scenario						
Mine	325	25%	1000	25%	864	851

[a] Farmland 1978
[b] Construction multiplier: 3.078
High scenario multiplier: 6.155
Low scenario multiplier: 3.078
[c] Household size: 2.66

Sources:
Farmland Industries, Inc. 1979.
Bureau of Mines 1974.
Woodward-Clyde Consultants 1980.

Table 10-20. EMPLOYEES ADJUSTED 1980 INCOME LEVELS

Wage Range		Number of Employees	
1978	1980[a]	Construction	Operation
7000 - 9999	8000 - 11,699	26	15
10,000 - 14,999	11,700 - 17,499	83	175
15,000 - 24,999	17,500 - 29,000	161	132
over 25,000	over 29,000	15	5

[a] Assumes 9 percent annual inflation in wages

Sources:
Farmland Industries, Inc. 1979.
Woodward-Clyde Consultants 1980.

Table 10-21. **ESTIMATED 1979 WAGE RATES FOR HARDEE COUNTY**

Employment Type	Wage Range (hourly earnings)	
	Starting	Average
Services	3.00	3.45
Agriculture		
(citrus pickers)	3.00	4.50
(grove maintenance)	3.00	3.40
Clerical	3.00	3.75
State Government		
(professionals)	4.80	-
County Government	-	5.39
Construction		5.32
Carpenter	-	5.00
Construction Labor	-	3.75
Electricians	-	6.00
Masons	-	6.00
Phosphate Mining	4.00	8.50
Operating Labor	-	7.25
Production Supervisor	-	10.38
Maintenance Personnel	-	7.79
Overhead Personnel	-	12.88

Source:
University of Florida 1978.

Table 10-22. SEQUENCE OF LAND USE CHANGES FROM PRESENT TO POST MINING.

	LAND USE AND COVER CLASSIFICATIONS*																	
	Improved Pasture		Citrus		Other** Ariculture		Pine Flatwoods/ Palmetto Range		Coniferous And Mixed Forest		Hardwood Forest		Freshwater Swamp		Freshwater Marsh		Mineral Extraction	
Phase	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
Present	2416	0	1917	0	153	0	937	0	373	0	417	0	1205	0	392	0	-	-
Pre-Mining (2 yrs)	1945	-19.5	1858	-3.1	153	0	918	-2.0	370	-0.8	406	-2.6	1186	-1.6	380	-3.1	594	-
Mining (1-4 yrs)	1351	-44.1	1864	-3.8	152	-0.7	847	-9.6	364	-2.4	356	-14.6	1143	-5.1	310	-20.9	1443	-
Mining (5-8 yrs)	1269	-47.5	1329	-30.7	66	-56.9	737	-21.3	363	-2.7	353	-15.3	1033	-14.3	243	-28.0	2417	-
Mining (9-12 yrs)	1428	-40.9	810	-57.7	284	+85.6	549	-41.4	324	-13.1	288	-30.9	1024	-15.0	303	-22.7	2680	-
Mining (13-16 yrs)	2116	-12.4	384	-80.0	283	+85.0	394	-58.0	323	-13.4	205	-50.8	981	-18.6	346	-11.7	2394	-
Mining (17-20 yrs)	2740	+13.4	160	-91.7	282	+84.3	354	-62.2	323	-13.4	187	-55.2	944	-21.7	351	-10.5	1989	-
Mining (21-25 yrs)	3798	+57.2	160	-91.7	282	+84.3	354	-62.2	323	-13.4	187	-55.2	944	-21.7	446	+13.8	583	
Post-Mining	4329	+79.2	160	-91.7	282	+84.3	354	-62.2	323	-13.4	187	-55.2	944	-21.7	446	+13.8	-	-
NET CHANGE	+1913	+79.2	-1757	-91.7	+129	+84.3	-583	-62.2	-50	-13.4	-230	-55.2	-261	-21.7	+54	+13.8	-	-

NOTE: Acres to be added of land use types not presently on the site are as follows: Planted Mixed Forest = 550 acres; Lakes = 235 acres.

*Some Level III designations have been used to describe the land use pattern more accurately.
**Includes upland experimental plantings in Sand-Clay Mix Area I.

Source: Adapted from Farmland Industries, Inc. 1979.

Table 10-23. 1979 LAND VALUES IN HARDEE COUNTY.

Category	Price Per Acre
Phosphate Reserves	$ 4000
Residential	3000
Citrus	2500
Improved Pasture	1500
Pines/Flatwood	1000
Mined Out Land and Other	800

Sources: Farmland Industries, Inc. 1979.
Hardee County 1980b.
Wauchula State Bank 1980a.

Table 10-24. PEAK HOUR TRAFFIC DURING MINE CONSTRUCTION.

Highway		Peak Hour Vehicles
S.R. 64 (westbound)		345
S.R. 64 (eastbound)		69
S.R. 663 (northbound)		35
Fort Green-Ona Road (southbound)		11
U.S. 17 (southbound)		259
	Total	719

Sources: Farmland Industries, Inc. (1981).

Table 10-25. **PEAK HOUR TRAFFIC DURING MINE OPERATION.**

Highway		Peak Hour Vehicles
S.R. 64 east of Ona	Incoming	139
	Outgoing	30
S.R. 64 west of Ona	Incoming	27
	Outgoing	6
S.R. 663 south of Ona	Incoming	14
	Outgoing	3
Fort Green-Ona Road north of Ona	Incoming	4
	Outgoing	1
U.S. 17 - Between Wauchula and Zolfo Springs	Incoming	103
	Outgoing	22[1]
	Total	349

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[1] Estimates for peak traffic on U.S. 17 were not available, however it was assumed that 75% of the westbound SR 64 traffic would travel U.S. 17 between Wauchula and Zolfo Springs.

Sources: Farmland Industries, Inc. (1981).

Table 10-26. HOUSING DEMAND FOR DIRECT AND INDIRECT EMPLOYMENT

Housing Type		Employment			
		Direct Employment # of Units	Indirect Employment # of Units		
			Low Scenario	High Scenario	Total
New Single Family	($48,000)[1]	10	33	66	43-76
Older Single Family	($30,000)[1]	27	86	172	113-199
Mobile Home	($12,000/Unit) plus $100/month rent)[2]	26	81	161	107-187
Rental Unit	($250/month)	17	54	106	71-123
				Total	334-585

[1] Assumes 30 year mortgage at 13.5 percent interest

[2] Assumes 10 year mortgage at 15 percent interest

Sources:
Farmland Industries, Inc. 1979.
Woodward-Clyde Consultants 1980.

Table 10-27. ASSESSED VALUE AND HARDEE COUNTY TAX REVENUE GENERATED BY THE FARMLAND PROJECT (000 dollars)

			County Revenue Generated[3]			
Assessed[1] Property Value	Capital Improvements[2] Assessed Value	Total Assessed Value	County	School District	Other	Total
$31,240	$55,000	$86,240	281	598	22	901

[1] Assumes $4,000/acre mine site

[2] Does not include exemptions for pollution control equipment

[3] 1979 millage rates totalling 10.398

Sources: Farmland Industries, Inc. 1981.
Hardee County 1980b.

Table 10-28. **HARDEE COUNTY EXPENDITURES GENERATED BY THE FARMLAND PROJECT**

One-Time Expenditures		Annual Expenditures	
Category	Cost ($1,000)	Category	Cost ($1,000)
Paving Fort Green-Ona Road	2,000	School District	301-528
Railroad Crossings S.R. 663(2)	160		
Turning Lanes and Signals at Intersection S.R. 64 and S.R. 663	200	Highway Maintenance[1]	100
1200 gal Fire Trucks (2)	70	Administrative and Service Salaries[2]	300
Total	2,430		701-928

[1] 4 miles of repaving at $25,000/mile

[2] Assumes 26 positions in county and municipal governments

Sources: Adley Associates, Inc. 1979d.

Hardee County 1979d.
Town of Wauchula 1979.

APPENDIX A

Table A-1. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 1 of 3).

Date	Water Level (in Feet)	
	Below MP	Above MSL
5-31-77	11.31	70.19
6-1-77	11.31	70.19
6-2-77	11.28	70.22
6-3-77	11.19	70.31
6-4-77	11.10	70.40
6-5-77	11.05	70.45
6-6-77	11.04	70.46
6-7-77	11.06	70.44
6-8-77	11.13	70.37
6-9-77	11.23	70.27
6-10-77	11.26	70.24
6-11-77	11.31	70.19
6-12-77	11.36	70.14
6-13-77	11.41	70.09
6-14-77	11.44	70.06
6-15-77	11.48	70.02
6-16-77	11.52	69.98
6-17-77	11.56	69.94
6-18-77	11.49	70.01
6-19-77	11.33	70.17
6-20-77	11.29	70.21
6-21-77	11.08	70.42
6-22-77	11.05	70.45
6-23-77	11.08	70.42
6-24-77	11.15	70.35
6-25-77	11.24	70.26
6-26-77	11.32	70.18
6-27-77	11.40	70.10
6-28-77	11.47	70.03
6-29-77	11.53	69.97
6-30-77	11.58	69.92
7-1-77	11.60	69.90
7-2-77	11.59	69.91
7-3-77	11.59	69.91
7-4-77	11.58	69.92
7-5-77	11.53	69.97
7-6-77	11.44	70.06
7-7-77	11.38	70.12
7-8-77	11.37	70.13
7-9-77	11.39	70.11
7-10-77	11.43	70.07
7-11-77	11.49	70.01
7-12-77	11.54	69.96
7-13-77	11.58	69.92
7-14-77	11.59	69.91
7-15-77	11.63	69.87
7-16-77	11.60	69.90
7-17-77	11.50	70.00
7-18-77	11.42	70.08
7-19-77	11.35	70.15
7-20-77	11.30	70.20
7-21-78	11.27	70.23
7-22-78	11.27	70.23
7-23-77	11.25	70.25
7-24-77	11.10	70.40
7-25-77	10.90	70.60
7-26-77	10.81	70.69
7-27-77	10.78	70.72
7-28-77	10.80	70.70
7-29-77	10.84	70.66
7-30-77	10.86	70.64
7-31-77	10.89	70.61
8-1-77	10.93	70.57
8-2-77	11.03	70.47
8-3-77	11.10	70.40
8-4-77	11.12	70.38
8-5-77	11.22	70.28
8-6-77	11.30	70.20
8-7-77	11.36	70.14
8-8-77	11.40	70.10
8-9-77	11.42	70.08
8-10-77	11.48	70.02
8-11-77	11.51	69.99
8-12-77	11.33	70.17
8-13-77	11.00	70.50
8-14-77	10.71	70.79
8-15-77	10.49	71.01
8-16-77	10.31	71.19
8-17-77	10.20	71.30
8-18-77	10.16	71.34
8-19-77	10.14	71.36
8-20-77	10.12	71.38
8-21-77	10.16	71.34
8-22-77	9.91	71.59
8-23-77	9.54	71.96
8-24-77	9.23	72.27
8-25-77	9.18	72.32
8-26-77	9.18	72.32
8-27-77	9.03	72.47
8-28-77	8.98	72.52
8-29-77	8.81	72.69
8-30-77	8.40	73.10
8-31-77	8.26	73.24
9-1-77	8.24	73.26
9-2-77	7.62	73.88
9-3-77	6.55	74.95
9-4-77	5.74	75.76
9-5-77	5.56	75.94
9-6-77	5.56	75.94
9-7-77	5.64	75.86
9-8-77	5.76	75.74
9-9-77	5.90	75.60
9-10-77	6.08	75.42
9-11-77	6.20	75.30
9-12-77	6.31	75.19
9-13-77	6.39	75.11
9-14-77	6.59	74.91
9-15-77	6.68	74.82
9-16-77	6.65	74.85
9-17-77	6.61	74.89
9-18-77	6.46	75.04
9-19-77	6.16	75.34
9-20-77	6.19	75.31
9-21-77	6.30	75.20
9-22-77	5.90	75.60
9-23-77	5.87	75.63
9-24-77	6.01	75.49
9-25-77	6.03	75.47
9-26-77	6.15	75.35
9-27-77	6.00	75.50
9-28-77	5.89	75.61
9-29-77	6.00	75.50
9-30-77	6.18	75.32
10-1-77	6.38	75.12
10-2-77	6.50	75.00
10-3-77	6.45	75.05
10-4-77	6.45	75.05
10-5-77	6.62	74.88
10-6-77	6.76	74.74
10-7-77	6.84	74.66
10-8-77	6.92	74.58
10-9-77	6.98	74.52
10-10-77	6.61	74.89
10-11-77	6.34	75.16
10-12-77	6.30	75.20
10-13-77	6.39	75.11
10-14-77	6.56	74.94
10-15-77	6.70	74.80
10-16-77	6.80	74.70
10-17-77	-	-
10-18-77	-	-
10-19-77	-	-
10-20-77	-	-
10-21-77	7.19	74.31
10-22-77	7.20	74.30
10-23-77	7.19	74.31
10-24-77	6.47	75.03
10-25-77	6.08	75.42
10-26-77	6.02	75.48
10-27-77	6.03	75.47
10-28-77	6.16	75.34
10-29-77	6.29	75.21
10-30-77	6.30	75.20
10-31-77	6.30	75.20
11-1-77	6.30	75.20
11-2-77	6.30	75.20
11-3-77	6.30	75.24
11-4-77	6.01	75.49
11-5-77	5.99	75.51
11-6-77	6.05	75.45
11-7-77	6.17	75.33
11-8-77	6.26	75.24
11-9-77	6.38	75.12
11-10-77	6.50	75.00
11-11-77	6.59	74.91

Table A-1. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 2 of 3).

	Water Level (in Feet)	
Date	**Below MP**	**Above MSL**
11-12-77	6.68	74.82
11-13-77	6.78	74.72
11-14-77	6.85	74.65
11-15-77	6.91	74.59
11-16-77	6.96	74.54
11-17-77	7.00	74.50
11-18-77	7.06	74.44
11-19-77	7.08	74.42
11-20-77	7.20	74.30
11-21-77	7.20	74.30
11-22-77	7.21	74.29
11-23-77	6.87	74.63
11-24-77	6.55	74.95
11-25-77	6.47	75.03
11-26-77	6.50	75.00
11-27-77	6.64	74.86
11-28-77	6.73	74.77
11-29-77	6.66	74.84
11-30-77	6.58	74.92
12-1-78	6.59	74.91
12-2-77	6.53	74.97
12-3-77	6.52	74.98
12-4-77	6.60	74.90
12-5-77	6.65	74.85
12-6-77	6.51	74.99
12-7-77	6.55	74.95
12-8-77	6.64	74.86
12-9-77	6.73	74.77
12-10-77	6.21	75.29
12-11-77	6.23	75.27
12-12-77	6.31	75.19
12-13-77	6.37	75.13
12-14-77	6.32	75.18
12-15-77	6.08	75.42
12-16-77	5.82	75.68
12-17-77	5.77	75.73
12-18-77	5.77	75.73
12-19-77	5.93	75.57
12-20-77	6.08	75.42
12-21-77	5.94	75.56
12-22-77	5.94	75.56
12-23-77	6.05	75.45
12-24-77	6.10	75.40
12-25-77	5.86	75.64
12-26-77	5.83	75.67
12-27-77	5.86	75.64
12-28-77	5.99	75.51
12-29-77	6.10	75.40
12-30-77	6.19	75.31
12-31-77	6.18	75.32
1-1-78	6.17	75.31
1-2-78	6.17	75.31
1-3-78	6.24	75.26
1-4-78	6.32	75.18
1-5-78	6.39	75.11
1-6-78	6.42	75.08
1-7-78	6.45	75.05
1-8-78	6.20	75.30
1-9-78	6.20	75.30
1-10-78	6.26	75.24
1-11-78	6.36	75.14
1-12-78	6.42	75.08
1-13-78	6.12	75.38
1-14-78	* --	--
1-15-78	--	--
1-16-78	--	--
1-17-78	--	--
1-18-78	--	--
1-19-78	--	--
1-20-78	--	--
1-21-78	--	--
1-22-78	--	--
1-23-78	--	--
1-24-78	--	--
1-25-78	--	--
1-26-78	--	--
1-27-78	5.73	75.77
1-28-78	5.84	75.66
1-29-78	5.94	75.56
1-30-78	6.02	75.48
1-31-78	6.08	75.42
2-1-78	* --	--
2-2-78	--	--
2-3-78	--	--
2-4-78	--	--
2-5-78	--	--
2-6-78	--	--
2-7-78	6.20	75.30
2-8-78	* --	--
2-9-78	--	--
2-10-78	--	--
2-11-78	--	--
2-12-78	--	--
2-13-78	5.67	75.83
2-14-78	6.04	75.46
2-15-78	6.13	75.37
2-16-78	5.68	75.82
2-17-78	5.28	76.22
2-18-78	4.91	76.59
2-19-78	4.89	76.61
2-20-78	4.88	76.62
2-21-78	4.84	76.66
2-22-78	4.91	76.59
2-23-78	5.09	76.41
2-24-78	5.21	76.29
2-25-78	5.35	76.15
2-26-78	5.46	76.04
2-27-78	5.55	75.95
2-28-78	5.62	75.88
3-1-78	5.65	75.85
3-2-78	5.69	75.81
3-3-78	5.02	76.48
3-4-78	4.90	76.60
3-5-78	4.92	76.58
3-6-78	5.04	76.46
3-7-78	5.17	76.33
3-8-78	5.31	76.19
3-9-78	4.77	76.73
3-10-78	4.75	76.75
3-11-78	4.84	76.66
3-12-78	4.98	76.52
3-13-78	5.13	76.37
3-14-78	5.28	76.22
3-15-78	5.42	76.08
3-16-78	5.51	75.99
3-17-78	5.62	75.88
3-18-78	5.82	75.68
3-19-78	5.93	75.57
3-20-78	5.97	75.53
3-21-78	6.02	75.48
3-22-78	6.18	75.32
3-23-78	6.25	75.25
3-24-78	6.23	75.27
3-25-78	6.27	75.23
3-26-78	6.31	75.19
3-27-78	6.37	75.13
3-28-78	6.45	75.05
3-29-78	6.48	75.02
3-30-78	6.56	74.94
3-31-78	6.63	74.87
4-1-78	6.70	74.80
4-2-78	6.76	74.74
4-3-78	6.85	74.65
4-4-78	6.93	74.57
4-5-78	6.97	74.53
4-6-78	7.02	74.48
4-7-78	7.09	74.41
4-8-78	7.14	74.36
4-9-78	7.22	74.28
4-10-78	7.29	74.21
4-11-78	7.38	74.12
4-12-78	7.45	74.05
4-13-78	7.52	73.98
4-14-78	7.57	73.93
4-15-78	7.63	73.87
4-16-78	7.70	73.80
4-17-78	7.78	73.72
4-18-78	7.85	73.65
4-19-78	7.90	73.60
4-20-78	7.96	73.54
4-21-78	8.05	73.45
4-22-78	8.12	73.38
4-23-78	8.20	73.30

* Recorder Malfunction

* Recorder Malfuction

Table A-1. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Concluded, Page 3 of 3).

Date	Water Level (in Feet) Below MP	Water Level (in Feet) Above MSL
4-24-78	8.26	73.24
4-25-78	8.31	73.19
4-26-78	8.30	73.12
4-27-78	8.47	73.03
4-28-78	8.55	72.95
4-29-78	8.63	72.87
4-30-78	8.69	72.81
5-1-78	8.74	72.76
5-2-78	8.71	72.79
5-3-78	8.87	72.63
5-4-78	8.78	72.72
5-5-78	8.72	72.78
5-6-78	8.68	72.82
5-7-78	8.61	72.89
5-8-78	8.64	72.86
5-9-78	8.72	72.78
5-10-78	8.82	72.68
5-11-78	8.89	72.61
5-12-78	8.97	72.53
5-13-78	9.05	72.45
5-14-78	9.13	72.37
5-15-78	9.22	72.28
5-16-78	9.32	72.18
5-17-78	9.43	72.07
5-18-78	9.45	72.05
5-19-78	9.31	72.19
5-20-78	9.15	72.35
5-21-78	9.10	72.40
5-22-78	9.13	72.37
5-23-78	9.20	72.30
5-24-78	9.28	72.22
5-25-78	9.35	72.15
5-26-78	9.44	72.06
5-27-78	9.52	71.98
5-28-78	9.55	71.95
5-29-78	9.60	71.90
5-30-78	9.67	71.83
5-31-78	9.75	71.75
6-1-78	9.84	71.66
6-2-78	9.89	71.61
6-3-78	9.86	71.64
6-4-78	9.72	71.70
6-5-78	9.67	71.83
6-6-78	9.67	71.83
6-7-78	9.67	71.83
6-8-78	9.61	71.89
6-9-78	8.78	72.72
6-10-78	7.50	74.00
6-11-78	5.83	75.67
6-12-78	5.40	76.10
6-13-78	5.39	76.11
6-14-78	5.69	75.81
6-15-78	5.94	75.56
6-16-78	6.11	75.39
6-17-78	6.24	75.26
6-18-78	6.37	75.13
6-19-78	6.08	75.42
6-20-78	5.99	75.51
6-21-78	5.90	75.50
6-22-78	5.32	76.18
6-23-78	5.21	76.29
6-24-78	5.25	76.25
6-25-78	5.29	76.21
6-26-78	5.64	75.86
6-27-78	5.87	75.63
6-28-78	6.03	75.47
6-29-78	6.20	75.30
6-30-78	6.33	75.17
7-1-78	6.43	75.07
7-2-78	6.34	75.16
7-3-78	6.08	75.42
7-4-78	6.04	75.46
7-5-78	6.24	75.26
7-6-78	* --	--
7-7-78	--	--
7-8-78	--	--
7-9-78	--	--
7-10-78	--	--
7-11-78	--	--
7-12-78	--	--
7-13-78	--	--
7-14-78	--	--
7-15-78	--	--
7-16-78	--	--
7-17-78	--	--
7-18-78	--	--
7-19-78	--	--
7-20-78	--	--
7-21-78	--	--
7-22-78	--	--
7-23-78	--	--
7-24-78	--	--
7-25-78	--	--
7-26-78	--	--
7-27-78	--	--
7-28-78	5.96	75.54
7-29-78	6.02	75.48
7-30-78	5.94	75.56
7-31-78	5.67	75.82
8-1-78	5.68	75.82
8-2-78	5.43	76.07
8-3-78	5.30	76.20
8-4-78	5.40	76.10
8-5-78	5.57	75.93
8-6-78	5.65	75.85
8-7-78	5.87	75.63
8-8-78	6.17	75.33
8-9-78	6.26	75.24
8-10-78	5.75	75.75
8-11-78	5.62	75.88
8-12-78	5.69	75.81
8-13-78	5.87	75.63
8-14-78	6.07	75.43
8-15-78	6.04	75.46
8-16-78	6.32	75.18
8-17-78	6.57	74.93
8-18-78	5.86	75.64
8-19-78	5.65	75.85
8-20-78	5.65	75.85
8-21-78	5.87	75.63
8-22-78	6.18	75.32
8-23-78	6.40	75.10

*No Record - Heavy rain washed out recorder house base

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table A-2. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 1 of 3).

Date	Water Level (in Feet)	
	Below MP	Above MSL
5-31-77	6.60	87.31
6-1-77	6.61	87.30
6-2-77	6.63	87.28
6-3-77	6.64	87.27
6-4-77	6.64	87.27
6-5-77	6.63	87.28
6-6-77	6.63	87.28
6-7-77	6.63	87.28
6-8-77	6.64	87.27
6-9-77	6.66	87.25
6-10-77	6.68	87.23
6-11-77	6.69	87.22
6-12-77	6.69	87.22
6-13-77	6.70	87.21
6-14-77	6.72	87.19
6-15-77	6.74	87.17
6-16-77	6.74	87.17
6-17-77	6.76	87.15
6-18-77	6.76	87.15
6-19-77	6.50	87.41
6-20-77	6.11	87.80
6-21-77	6.05	87.86
6-22-77	8.12	85.79
6-23-77	8.11	85.80
6-24-77	8.12	85.79
6-25-77	8.16	85.75
6-26-77	8.26	85.65
6-27-77	8.37	85.54
6-28-77	8.44	85.47
6-29-77	8.35	85.56
6-30-77	8.54	85.37
7-1-77	8.38	85.53
7-2-77	8.04	85.87
7-3-77	7.79	86.12
7-4-77	7.49	86.42
7-5-77	7.17	86.74
7-6-77	6.91	87.00
7-7-77	6.86	87.05
7-8-77	6.88	87.03
7-9-77	6.92	86.99
7-10-77	7.02	86.89
7-11-77	7.12	86.79
7-12-77	7.17	86.74
7-13-77	7.11	86.80
7-14-77	7.10	86.81
7-15-77	7.00	86.91
7-16-77	6.66	87.25
7-17-77	6.23	87.68
7-18-77	5.87	88.04
7-19-77	5.86	88.05
7-20-77	5.97	87.94
7-21-77	5.79	88.12
7-22-77	5.66	88.25
7-23-77	5.24	88.67
7-24-77	4.80	89.11
7-25-77	4.68	89.23
7-26-77	4.88	89.03
7-27-77	5.03	88.88
7-28-77	5.19	88.72
7-29-77	4.24	89.67
7-30-77	4.04	89.87
7-31-77	4.25	89.66
8-1-77	4.64	89.27
8-2-77	4.80	89.11
8-3-77	4.84	89.07
8-4-77	4.98	88.93
8-5-77	5.18	88.73
8-6-77	4.91	89.00
8-7-77	4.75	89.16
8-8-77	4.76	89.15
8-9-77	4.85	89.06
8-10-77	4.45	89.46
8-11-77	4.47	89.44
8-12-77	4.02	89.89
8-13-77	3.43	90.48
8-14-77	2.94	90.97
8-15-77	2.93	90.98
8-16-77	2.68	91.23
8-17-77	2.71	91.20
8-18-77	3.23	90.68
8-19-77	3.60	90.31
8-20-77	4.05	89.86
8-21-77	4.41	89.50
8-22-77	3.72	90.19
8-23-77	3.39	90.52
8-24-77	3.35	90.56
8-25-77	3.40	90.51
8-26-77	3.81	90.10
8-27-77	3.68	90.23
8-28-77	3.73	90.18
8-29-77	3.93	89.98
8-30-77	3.88	90.03
8-31-77	3.93	89.98
9-1-77	4.15	89.76
9-2-77	4.02	89.89
9-3-77	3.75	90.16
9-4-77	3.73	90.18
9-5-77	3.62	90.29
9-6-77	3.76	90.15
9-7-77	3.95	89.96
9-8-77	4.16	89.75
9-9-77	4.36	89.55
9-10-77	4.79	89.12
9-11-77	5.05	88.86
9-12-77	5.23	88.68
9-13-77	5.43	88.48
9-14-77	5.58	88.33
9-15-77	5.70	88.21
9-16-77	5.71	88.20
9-17-77	5.60	88.31
9-18-77	5.59	88.32
9-19-77	5.41	88.50
9-20-77	5.43	88.48
9-21-77	5.54	88.37
9-22-77	5.43	88.48
9-23-77	5.40	88.51
9-24-77	5.42	88.49
9-25-77	5.52	88.39
9-26-77	5.16	88.75
9-27-77	4.58	89.33
9-28-77	4.48	89.43
9-29-77	4.58	89.33
9-30-77	4.71	89.20
10-1-77	4.96	88.95
10-2-77	5.19	88.72
10-3-77	5.38	88.53
10-4-77	5.45	88.46
10-5-77	5.59	88.32
10-6-77	5.74	88.17
10-7-77	5.92	87.99
10-8-77	6.00	87.91
10-9-77	6.05	87.86
10-10-77	5.93	87.98
10-11-77	5.68	88.23
10-12-77	5.61	88.30
10-13-77	5.64	88.27
10-14-77	5.78	88.13
10-15-77	5.89	88.02
10-16-77	6.01	87.90
10-17-77	6.08	87.83
10-18-77	6.13	87.78
10-19-77	6.15	87.76
10-20-77	6.19	87.72
10-21-77	6.22	87.69
10-22-77	6.25	87.66
10-23-77	6.25	87.66
10-24-77	5.83	88.08
10-25-77	5.27	88.64
10-26-77	5.09	88.82
10-27-77	5.07	88.84
10-28-77	5.13	88.78
10-29-77	5.27	88.64
10-30-77	5.40	88.51
10-31-77	5.53	88.38
11-1-77	5.64	88.27
11-2-77	5.73	88.18
11-3-77	5.31	88.60
11-4-77	4.70	89.21
11-5-77	4.57	89.34
11-6-77	4.60	89.31
11-7-77	4.71	89.20
11-8-77	4.81	89.10
11-9-77	4.97	88.94
11-10-77	5.15	88.76
11-11-77	5.32	88.59
11-12-77	5.50	88.41
11-13-77	5.64	88.27
11-14-77	5.76	88.15
11-15-77	5.84	88.07

Table A-2. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 2 of 3).

Date	Water Level (in Feet) Below MP	Above MSL
11-16-77	5.93	87.98
11-17-77	5.98	87.93
11-18-77	6.04	87.87
11-19-77	6.08	87.83
11-20-77	6.13	87.78
11-21-77	6.17	87.78
11-22-77	6.21	87.70
11-23-77	5.86	88.05
11-24-77	5.29	88.62
11-25-77	.97	88.94
11-26-77	4.96	88.95
11-27-77	5.12	88.79
11-28-77	-	-
11-29-77	5.11	88.80
11-30-77	5.02	88.89
12-1-77	5.00	88.91
12-2-77	4.73	89.18
12-3-77	4.67	89.24
12-4-77	4.74	89.17
12-5-77	4.83	89.08
12-6-77	4.33	89.58
12-7-77	4.40	89.51
12-8-77	4.62	89.29
12-9-77	3.81	90.10
12-10-77	3.80	90.11
12-11-77	3.94	89.97
12-12-77	4.13	89.78
12-13-77	4.05	89.86
12-14-77	3.83	90.08
12-15-77	3.20	90.71
12-16-77	2.89	91.02
12-17-77	2.89	91.02
12-18-77	2.96	90.95
12-19-77	3.62	90.29
12-20-77	4.00	89.91
12-21-77	3.15	90.76
12-22-77	3.34	90.57
12-23-77	3.92	89.99
12-24-77	4.12	89.79
12-25-77	3.22	90.69
12-26-77	3.40	90.51
12-27-77	3.77	90.14
12-28-77	4.15	89.76
12-29-77	4.40	89.51
12-30-77	4.47	89.44
12-31-77	4.35	89.56
1-1-78	4.25	89.66
1-2-78	4.36	89.55
1-3-78	4.66	89.25
1-4-78	4.90	89.01
1-5-78	* -	-
1-6-78	-	-
1-7-78	-	-
1-8-78	-	-
1-9-78	-	-
1-10-78	4.94	88.97
1-11-78	5.03	88.88
1-12-78	5.15	88.76
1-13-78	4.08	89.83
1-14-78	3.96	89.95
1-15-78	4.05	89.86
1-16-78	4.31	89.60
1-17-78	3.38	90.53
1-18-78	3.12	90.79
1-19-78	** -	-
1-20-78	-	-
1-21-78	-	-
1-22-78	-	-
1-23-78	-	-
1-24-78	-	-
1-25-78	-	-
1-26-78	-	-
1-27-78	-	-
1-28-78	-	-
1-29-78	-	-
1-30-78	-	-
1-31-78	-	-
2-1-78	-	-
2-2-78	-	-
2-3-78	-	-
2-4-78	-	-
2-5-78	-	-
2-6-78	-	-
2-7-78	5.32	88.59
2-8-78	5.05	88.86
2-9-78	4.56	89.35
2-10-78	4.55	89.36
2-11-78	4.66	89.25
2-12-78	4.81	89.10
2-13-78	4.93	88.98
2-14-78	5.05	88.86
2-15-78	5.19	88.72
2-16-78	4.22	89.69
2-17-78	3.39	90.52
2-18-78	2.94	90.97
2-19-78	2.62	91.29
2-20-78	2.38	91.53
2-21-78	2.39	91.52
2-22-78	2.91	91.00
2-23-78	3.67	90.24
2-24-78	3.90	90.01
2-25-78	4.15	89.76
2-26-78	4.34	89.57
2-27-78	4.51	89.40
2-28-78	4.62	89.29
3-1-78	4.72	89.19
3-2-78	4.80	89.11
3-3-78	3.39	90.52
3-4-78	3.38	90.53
3-5-78	3.65	90.26
3-6-78	3.89	90.02
3-7-78	4.01	89.90
3-8-78	3.10	90.81
3-9-78	2.62	91.29
3-10-78	2.74	91.17
3-11-78	3.11	90.80
3-12-78	3.48	90.43
3-13-78	3.80	90.11
3-14-78	4.05	89.86
3-15-78	4.28	89.63
3-16-78	4.44	89.47
3-17-78	4.69	89.22
3-18-78	4.93	88.98
3-19-78	5.08	88.83
3-20-78	5.17	88.74
3-21-78	5.24	88.67
3-22-78	5.29	88.62
3-23-78	5.36	88.55
3-24-78	5.42	88.49
3-25-78	5.48	88.43
3-26-78	5.53	88.38
3-27-78	5.60	88.31
3-28-78	5.67	88.24
3-29-78	5.74	88.17
3-30-78	5.78	88.13
3-31-78	5.84	88.07
4-1-78	5.90	87.01
4-2-78	5.96	87.95
4-3-78	6.02	87.89
4-4-78	6.08	87.83
4-5-78	6.13	87.78
4-6-78	6.16	87.75
4-7-78	6.23	87.68
4-8-78	6.28	87.63
4-9-78	6.33	87.58
4-10-78	6.39	87.52
4-11-78	6.45	87.46
4-12-78	6.52	87.39
4-13-78	6.57	87.34
4-14-78	6.62	87.29
4-15-78	6.66	87.25
4-16-78	6.71	87.20
4-17-78	6.77	87.14
4-18-78	6.83	87.08
4-19-78	6.89	87.02
4-20-78	6.93	86.98
4-21-78	6.99	86.92
4-22-78	7.06	86.85
4-23-78	7.13	86.78
4-24-78	7.18	86.73
4-25-78	7.24	86.67
4-26-78	7.29	86.62
4-27-78	7.36	86.55
4-28-78	7.43	86.48
4-29-78	7.48	86.43
4-30-78	7.53	86.38

* Chart ran out

** Recorder knocked over by cows

Table A-2. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Concluded, Page 3 of 3).

Date	Water Level (in Feet)	
	Below MP	Above MSL
5-1-78	7.58	86.33
5-2-78	7.63	86.28
5-3-78	7.68	86.23
5-4-78	7.63	86.28
5-5-78	7.48	86.43
5-6-78	7.26	86.65
5-7-78	6.98	86.93
5-8-78	6.87	87.04
5-9-78	6.84	87.07
5-10-78	6.85	87.06
5-11-78	6.89	87.02
5-12-78	6.97	86.94
5-13-78	7.07	86.84
5-14-78	7.17	86.74
5-15-78	7.27	86.64
5-16-78	7.38	86.53
5-17-78	7.49	86.42
5-18-78	7.51	86.40
5-19-78	7.23	86.68
5-20-78	6.90	87.01
5-21-78	6.80	87.11
5-22-78	6.79	87.12
5-23-78	6.82	87.09
5-24-78	6.89	87.02
5-25-78	6.98	86.93
5-26-78	7.08	86.84
5-27-78	7.18	86.73
5-28-78	7.27	86.64
5-29-78	7.33	86.58
5-30-78	7.41	86.50
5-31-78	7.45	86.46
6-1-78	7.53	86.38
6-2-78	7.61	86.30
6-3-78	7.63	86.28
6-4-78	7.36	86.55
6-5-78	7.22	86.69
6-6-78	7.18	86.71
6-7-78	7.18	86.73
6-8-78	6.85	87.06
6-9-78	6.52	87.39
6-10-78	5.56	88.39
6-11-78	4.13	89.78
6-12-78	3.91	90.72
6-13-78	3.84	90.07
6-14-78	4.14	89.77
6-15-78	4.41	89.50
6-16-78	4.65	89.26
6-17-78	4.86	89.05
6-18-78	5.02	88.89
6-19-78	3.61	90.30
6-20-78	3.40	90.51
6-21-78	2.64	91.27
6-22-78	1.75	92.15
6-23-78	1.75	92.15
6-24-78	2.40	91.51
6-25-78	2.51	91.40
6-26-78	3.20	90.71
6-27-78	3.78	90.13
6-28-78	4.13	89.78
6-29-78	4.43	89.48
6-30-78	4.64	89.27
7-1-78	3.24	90.67
7-2-78	3.24	90.67
7-3-78	2.55	91.36
7-4-78	2.66	91.25
7-5-78	2.89	91.02
7-6-78	2.23	91.68
7-7-78	1.64	92.27
7-8-78	2.05	91.86
7-9-78	2.58	91.33
7-10-78	2.66	91.25
7-11-78	3.37	90.54
7-12-78	3.91	90.00
7-13-78	4.12	89.79
7-14-78	3.86	90.05
7-15-78	3.63	90.28
7-16-78	3.69	90.22
7-17-78	2.06	91.85
7-18-78	1.97	91.94
7-19-78	2.01	91.90
7-20-78	2.24	91.67
7-21-78	2.57	91.34
7-22-78	2.99	90.92
7-23-78	3.38	90.53
7-24-78	2.78	91.13
7-25-78	3.36	90.55
7-26-78	3.79	90.12
7-27-78	2.26	91.65
7-28-78	3.00	90.91
7-29-78	3.11	90.80
7-30-78	3.32	90.59
7-31-78	2.94	90.97
8-1-78	2.80	91.11
8-2-78	2.98	90.93
8-3-78	2.41	91.50
8-4-78	2.02	91.89
8-5-78	2.60	91.31
8-6-78	2.95	90.96
8-7-78	2.94	90.97
8-8-78	3.08	90.83
8-9-78	3.65	90.26
8-10-78	2.99	90.92
8-11-78	3.15	90.76
8-12-78	3.23	90.68
8-13-78	3.35	90.56
8-14-78	3.72	90.19
8-15-78	3.90	90.01
8-16-78	3.96	89.95
8-17-78	4.34	89.57
8-18-78	3.89	90.02
8-19-78	4.29	89.62
8-20-78	4.61	89.30
8-21-78	4.87	89.04
8-22-78	5.06	88.85
8-23-78	5.20	88.71

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table A-3. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 1 of 3).

Date	Water Level (in Feet)	
	Below MP	Above MSL
5-31-77	8.27	49.22
6-1-77	8.25	49.24
6-2-77	8.24	49.25
6-3-77	8.12	49.37
6-4-77	8.05	49.44
6-5-77	8.02	49.47
6-6-77	7.98	49.51
6-7-77	7.97	49.52
6-8-77	8.00	49.49
6-9-77	8.03	49.46
6-10-77	8.06	49.43
6-11-77	8.10	49.39
6-12-77	8.14	49.35
6-13-77	8.12	49.37
6-14-77	8.06	49.43
6-15-77	8.00	49.49
6-16-77	8.01	49.48
6-17-77	8.02	49.47
6-18-77	7.98	49.51
6-19-77	7.94	49.55
6-20-77	7.93	49.56
6-21-77	7.90	49.59
6-22-77	7.89	49.60
6-23-77	8.00	49.49
6-24-77	8.05	49.44
6-25-77	8.11	49.38
6-26-77	8.15	49.34
6-27-77	8.21	49.28
6-28-77	8.27	49.22
6-29-77	8.31	49.18
6-30-77	8.31	49.18
7-1-77	7.84	49.65
7-2-77	7.44	50.05
7-3-77	7.26	50.23
7-4-77	7.14	50.35
7-5-77	6.97	50.52
7-6-77	6.84	50.65
7-7-77	6.82	50.67
7-8-77	6.85	50.64
7-9-77	6.84	50.65
7-10-77	6.88	50.61
7-11-77	6.93	50.56
7-12-77	6.98	50.51
7-13-77	7.00	50.49
7-14-77	6.98	50.51
7-15-77	6.97	50.52
7-16-77	6.74	50.75
7-17-77	6.61	50.88
7-18-77	6.58	50.91
7-19-77	6.59	50.90
7-20-77	6.55	50.94
7-21-77	6.58	50.91
7-22-77	6.60	50.89
7-23-77	6.66	50.83
7-24-77	6.47	51.02
7-25-77	6.42	51.07
7-26-77	6.42	51.07
7-27-77	6.50	50.99
7-28-77	6.56	50.93
7-29-77	6.63	50.86
7-30-77	6.57	50.92
7-31-77	6.61	50.88
8-1-77	6.67	50.82
8-2-77	6.73	50.76
8-3-77	6.80	50.69
8-4-77	6.84	50.65
8-5-77	6.93	50.56
8-6-77	6.97	50.52
8-7-77	6.96	50.53
8-8-77	-	-
8-9-77	6.96	50.53
8-10-77	7.00	50.49
8-11-77	6.96	50.53
8-12-77	6.88	50.61
8-13-77	6.72	50.57
8-14-77	6.40	51.09
8-15-77	6.23	50.26
8-16-77	6.04	50.45
8-17-77	5.98	50.51
8-18-77	5.99	50.50
8-19-77	5.98	50.51
8-20-77	5.99	50.50
8-21-77	6.03	50.46
8-22-77	5.79	51.70
8-23-77	5.59	51.90
8-24-77	5.57	51.92
8-25-77	5.59	51.90
8-26-77	5.67	51.82
8-27-77	5.59	51.90
8-28-77	5.57	51.92
8-29-77	5.52	51.97
8-30-77	5.44	52.05
8-31-77	5.43	52.06
9-1-77	5.50	51.99
9-2-77	5.08	52.41
9-3-77	4.80	52.69
9-4-77	4.51	52.98
9-5-77	4.56	52.93
9-6-77	4.75	52.74
9-7-77	4.79	52.70
9-8-77	4.78	52.71
9-9-77	4.81	52.68
9-10-77	4.86	52.63
9-11-77	4.91	52.58
9-12-77	4.97	52.52
9-13-77	5.01	52.48
9-14-77	5.08	52.41
9-15-77	5.16	52.33
9-16-77	5.05	52.44
9-17-77	5.04	52.45
9-18-77	4.93	52.56
9-19-77	4.92	52.57
9-20-77	4.97	52.52
9-21-77	5.04	52.45
9-22-77	5.04	52.45
9-23-77	5.07	52.42
9-24-77	5.15	52.34
9-25-77	5.04	52.45
9-26-77	4.81	52.68
9-27-77	4.66	52.83
9-28-77	4.72	52.77
9-29-77	4.78	52.71
9-30-77	4.88	52.61
10-1-77	4.96	52.53
10-2-77	5.02	52.47
10-3-77	5.02	52.47
10-4-77	5.06	52.43
10-5-77	5.17	52.32
10-6-77	5.25	52.24
10-7-77	5.29	52.20
10-8-77	5.34	52.15
10-9-77	5.40	52.09
10-10-77	5.34	52.15
10-11-77	5.33	52.16
10-12-77	5.33	52.16
10-13-77	5.40	52.09
10-14-77	5.50	51.99
10-15-77	5.57	51.92
10-16-77	5.60	51.89
10-17-77	5.65	51.84
10-18-77	5.70	51.79
10-19-77	5.73	51.76
10-20-77	5.78	51.71
10-21-77	5.82	51.67
10-22-77	5.82	51.67
10-23-77	5.81	51.68
10-24-77	5.44	52.05
10-25-77	5.31	52.18
10-26-77	5.29	52.20
10-27-77	5.29	52.20
10-28-77	5.33	52.16
10-29-77	5.38	52.11
10-30-77	5.41	52.08
10-31-77	5.44	52.05
11-1-77	5.47	52.02
11-2-77	5.49	52.00
11-3-77	5.54	51.95
11-4-77	5.33	52.16
11-5-77	5.24	52.25
11-6-77	5.29	52.20
11-7-77	5.34	52.15
11-8-77	5.38	52.11
11-9-77	5.44	52.05

Table A-3. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 2 of 3).

	Water Level (in Feet)	
Date	Below MP	Above MSL
11-10-77	5.49	52.00
11-11-77	5.55	51.94
11-12-77	5.60	51.89
11-13-77	5.65	51.84
11-14-77	5.68	51.81
11-15-77	5.71	51.78
11-16-77	5.73	51.76
11-17-77	5.75	51.74
11-18-77	5.80	51.69
11-19-77	5.81	51.68
11-20-77	5.85	51.64
11-21-77	5.88	51.61
11-22-77	5.89	51.60
11-23-77	5.66	51.83
11-24-77	5.57	51.92
11-25-77	5.54	51.95
11-26-77	5.57	51.98
11-27-77	5.66	51.83
11-28-77	5.70	51.79
11-29-77	5.68	51.81
11-30-77	5.66	51.83
12-1-77	5.67	51.82
12-2-77	5.68	51.81
12-3-77	5.68	51.81
12-4-77	5.73	51.76
12-5-77	5.75	51.74
12-6-77	5.72	51.77
12-7-77	5.77	51.72
12-8-77	5.81	51.68
12-9-77	5.66	51.83
12-10-77	5.66	51.83
12-11-77	5.68	51.81
12-12-77	5.71	51.78
12-13-77	5.74	51.75
12-14-77	5.73	51.76
12-15-77	5.72	51.77
12-16-77	5.66	51.83
12-17-77	5.62	51.87
12-18-77	5.63	51.86
12-19-77	5.71	51.78
12-20-77	5.77	51.72
12-21-77	5.72	51.77
12-22-77	5.72	51.77
12-23-77	5.76	51.73
12-24-77	5.76	51.73
12-25-77	5.67	51.82
12-26-77	5.67	51.82
12-27-77	5.70	51.79
12-28-77	5.74	51.75
12-29-77	5.77	51.72
12-30-77	5.78	51.71
12-31-77	5.78	51.71
1-1-78	5.78	51.71
1-2-78	5.78	51.71
1-3-78	5.82	51.67
1-4-78	5.86	51.63
1-5-78	5.88	51.61
1-6-78	5.88	51.61
1-7-78	5.90	51.59
1-8-78	5.81	51.68
1-9-78	5.80	51.69
1-10-78	5.85	51.64
1-11-78	5.87	51.62
1-12-78	5.88	51.61
1-13-78	5.70	51.79
1-14-78	5.70	51.79
1-15-78	5.73	51.76
1-16-78	5.78	51.71
1-17-78	5.63	51.86
1-18-78	5.60	51.89
1-19-78	5.44	52.05
1-20-78	5.44	52.05
1-21-78	5.47	52.02
1-22-78	5.48	52.01
1-23-78	5.49	52.00
1-24-78	5.46	52.03
1-25-78	5.45	52.04
1-26-78	5.46	52.03
1-27-78	5.51	51.98
1-28-78	5.52	51.97
1-29-78	5.54	51.95
1-30-78	5.55	51.94
1-31-78	5.56	51.93
2-1-78	5.56	51.93
2-2-78	5.52	51.97
2-3-78	5.52	51.97
2-4-78	5.53	51.96
2-5-78	5.56	51.93
2-6-78	5.57	51.92
2-7-78	5.61	51.88
2-8-78	5.50	51.99
2-9-78	5.44	52.05
2-10-78	5.45	52.04
2-11-78	5.50	51.99
2-12-78	5.55	51.94
2-13-78	5.57	51.92
2-14-78	5.60	51.89
2-15-78	5.65	51.84
2-16-78	5.42	52.07
2-17-78	5.33	52.16
2-18-78	5.10	52.39
2-19-78	5.11	52.38
2-20-78	5.03	52.46
2-21-78	5.03	52.46
2-22-78	5.06	52.43
2-23-78	5.06	52.43
2-24-78	5.06	52.43
2-25-78	5.07	52.42
2-26-78	5.07	52.42
2-27-78	5.08	52.41
2-28-78	5.08	52.41
3-1-78	5.08	52.41
3-2-78	5.07	52.42
3-3-78	4.71	52.78
3-4-78	4.72	52.77
3-5-78	4.80	52.69
3-6-78	4.83	52.66
3-7-78	4.84	52.65
3-8-78	4.87	52.62
3-9-78	4.42	53.01
3-10-78	4.42	53.01
3-11-78	4.53	52.96
3-12-78	4.60	52.89
3-13-78	4.65	52.84
3-14-78	4.67	52.82
3-15-78	4.72	52.77
3-16-78	4.75	52.74
3-17-78	4.78	52.71
3-18-78	4.86	52.63
3-19-78	4.89	52.60
3-20-78	4.89	52.60
3-21-78	4.92	52.57
3-22-78	4.95	52.54
3-23-78	5.00	52.49
3-24-78	5.05	52.44
3-25-78	5.10	52.39
3-26-78	5.15	52.34
3-27-78	5.20	52.29
3-28-78	5.25	52.24
3-29-78	5.30	52.19
3-30-78	5.35	52.14
3-31-78	5.40	52.09
4-1-78	5.45	52.04
4-2-78	5.49	52.00
4-3-78	5.55	51.94
4-4-78	5.61	51.88
4-5-78	5.64	51.85
4-6-78	5.67	51.82
4-7-78	5.72	51.77
4-8-78	5.76	51.73
4-9-78	5.80	51.69
4-10-78	5.85	51.64
4-11-78	5.91	51.58
4-12-78	5.95	51.54
4-13-78	6.00	51.49
4-14-78	6.04	51.45
4-15-78	6.08	51.41
4-16-78	6.13	51.36
4-17-78	6.16	51.33
4-18-78	6.21	51.28
4-19-78	6.24	51.25
4-20-78	6.29	51.20
4-21-78	6.35	51.14
4-22-78	6.40	51.09
4-23-78	6.45	51.04

Table A-3. DAILY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, WELL CP-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Concluded, Page 3 of 3).

Date	Water Level (in Feet) Below MP	Water Level (in Feet) Above MSL
4-24-78	6.47	51.02
4-25-78	6.50	50.99
4-26-78	6.54	50.95
4-27-78	6.60	50.89
4-28-78	6.65	50.84
4-29-78	6.60	50.81
4-30-78	6.70	50.79
5-1-78	6.72	50.77
5-2-78	6.75	50.74
5-3-78	6.79	50.70
5-4-78	6.64	50.85
5-5-78	6.63	50.86
5-6-78	6.27	51.22
5-7-78	6.15	51.34
5-8-78	6.16	51.33
5-9-78	6.16	51.33
5-10-78	6.20	51.29
5-11-78	6.23	51.26
5-12-78	6.29	51.20
5-13-78	6.34	51.15
5-14-78	6.39	51.10
5-15-78	6.53	50.96
5-16-78	6.53	50.96
5-17-78	6.61	50.88
5-18-78	6.55	50.94
5-19-78	6.40	51.09
5-20-78	6.35	51.14
5-21-78	6.39	51.10
5-22-78	6.40	51.09
5-23-78	6.45	51.04
5-24-78	6.50	50.99
5-25-78	6.54	50.95
5-26-78	6.61	50.88
5-27-78	6.66	50.83
5-28-78	6.68	50.81
5-29-78	6.69	50.80
5-30-78	6.74	50.82
5-31-78	6.81	50.68
6-1-78	6.89	50.60
6-2-78	6.89	50.60
6-3-78	6.89	50.60
6-4-78	6.82	50.67
6-5-78	6.80	50.69
6-6-78	6.76	50.73
6-7-78	6.70	50.79
6-8-79	6.31	51.18
6-9-78	6.13	51.36
6-10-78	5.70	51.79
6-11-78	4.99	52.50
6-12-78	4.94	52.55
6-13-78	4.87	52.62
6-14-78	4.83	52.66
6-15-78	4.80	52.69
6-16-78	4.79	52.70
6-17-78	4.82	52.67
6-18-78	4.86	52.63
6-19-78	4.75	52.74
6-20-78	4.74	52.75
6-21-78	4.68	52.81
6-22-78	4.43	53.06
6-23-78	4.39	53.10
6-24-78	4.48	53.01
6-25-78	4.48	53.01
6-26-78	4.63	52.86
6-27-78	4.74	52.75
6-28-78	4.81	52.68
6-29-78	4.90	52.59
6-30-78	4.97	52.52
7-1-78	4.52	52.97
7-2-78	4.32	52.17
7-3-78	4.32	53.17
7-4-78	4.38	53.11
7-5-78	4.39	53.10
7-6-78	4.39	53.10
7-7-78	4.08	53.41
7-8-78	4.08	53.41
7-9-78	4.18	53.31
7-10-78	4.27	53.22
7-11-78	4.39	53.10
7-12-78	4.49	53.00
7-13-78	4.56	52.93
7-14-78	4.65	52.84
7-15-78	4.52	52.97
7-16-78	4.43	53.06
7-17-78	4.27	53.22
7-18-78	4.28	53.21
7-19-78	4.10	53.39
7-20-78	4.12	53.37
7-21-78	4.24	53.25
7-22-78	4.38	53.11
7-23-78	4.46	53.03
7-24-78	4.49	53.00
7-25-78	4.58	52.91
7-26-78	4.67	52.82
7-27-78	4.09	53.40
7-28-78	4.08	53.41
7-29-78	4.09	53.40
7-30-78	4.04	53.45
7-31-78	3.99	53.50
8-1-78	3.99	53.50
8-2-78	3.95	53.54
8-3-78	3.73	53.76
8-4-78	3.75	53.74
8-5-78	3.94	53.55
8-6-78	4.04	53.45
8-7-78	4.14	53.35
8-8-78	4.24	53.25
8-9-78	4.30	53.19
8-10-78	4.35	53.14
8-11-78	4.35	53.14
8-12-78	4.43	53.06
8-13-78	4.47	53.02
8-14-78	4.05	53.44
8-15-78	4.05	53.44
8-16-78	4.10	53.39
8-17-78	4.18	53.31
8-18-78	4.19	53.30
8-19-78	4.28	53.21
8-20-78	4.36	53.13
8-21-78	4.46	53.03
8-22-78	4.55	52.94
8-23-78	4.63	52.86

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 1 of 6).

Date	Piezometer FP-1		Piezometer FP-2	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	6.25	94.65	5.18	88.92
6-14-77	6.70	94.20	5.36	88.74
7-20-77	4.10	96.80	0.98	93.12
8-16-77	2.15	98.75	0.33	93.77
9-15-77	2.49	98.41	2.69	91.41
10-27-77	1.75	99.15	0.48	93.62
11-18-77	2.93	97.97	2.74	91.36
12-13-77	2.42	98.48	1.40	92.70
1-10-78	2.42	98.48	1.90	92.20
2-13-78	2.39	98.51	2.13	91.97
3-23-78	2.50	98.40	2.98	91.12
4-17-78	4.21	96.69	4.25	89.85
5-19-78	4.51	96.39	4.96	89.14
6-23-78	2.64	98.26	0.25	93.85
7-27-78	2.20	98.70	1.95	92.15
8-22-78	1.87	99.03	2.75	91.35

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Date	Piezometer FP-3		Piezometer FP-4	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	7.57	86.83	5.98	76.82
6-14-77	7.51	86.89	5.91	76.89
7-20-77	5.45	88.95	3.44	79.36
8-16-77	2.71	91.69	0.37	82.43
9-15-77	2.75	91.65	2.55	80.25
10-27-77	2.20	92.20	2.35	80.45
11-18-77	3.23	91.17	2.84	79.96
12-13-77	2.66	91.74	1.57	81.23
1-10-78	2.91	91.49	1.69	81.11
2-13-78	2.63	91.77	1.94	80.86
3-23-78	2.81	91.59	2.70	80.10
4-17-78	4.09	90.31	4.00	78.80
5-19-78	4.83	89.57	4.54	78.26
6-23-78	1.79	92.61	1.80	81.00
7-27-78	2.39	92.01	1.59	81.21
8-22-78	2.79	91.61	2.77	80.03

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 2 of 6).

Date	Piezometer FP-5		Piezometer FP-6	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	6.47	72.33	6.39	72.81
6-14-77	6.13	72.67	6.35	72.85
7-20-77	3.09	75.71	4.05	75.15
8-16-77	+0.42	79.22	2.53	76.67
9-15-77	2.90	75.90	2.77	76.43
10-27-77	2.51	76.29	2.89	76.31
11-18-77	3.36	75.44	3.55	75.65
12-13-77	1.84	76.96	3.18	76.02
1-10-78	2.18	76.62	3.36	75.84
2-13-78	2.40	76.40	3.19	76.01
3-23-78	3.15	75.65	3.11	76.09
4-17-78	4.60	74.20	4.13	75.07
5-15-78	5.36	73.44	5.08	74.12
6-23-78	1.46	77.34	1.51	77.69
7-27-78	1.84	76.96	2.25	76.95
8-22-78	2.66	76.14	3.15	76.05

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

+Water level is above land surface

Date	Piezometer FP-7		Piezometer FP-8	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	5.42	76.58	9.95	65.35
6-14-77	5.43	76.57	10.03	65.27
7-20-77	4.86	77.14	8.83	66.47
8-16-77	3.44	78.56	7.31	67.99
9-15-77	2.71	79.29	4.80	70.50
10-27-77	2.52	79.48	4.73	70.57
11-18-77	3.05	78.95	5.70	69.60
12-13-77	2.74	79.26	4.52	70.78
1-10-78	2.86	79.14	4.98	70.32
2-13-78	2.88	79.12	3.92	71.38
3-23-78	2.90	79.10	4.67	70.63
4-17-78	3.81	78.19	6.51	68.79
5-19-78	6.81	75.19	7.59	67.71
6-23-78	2.02	79.98	3.83	71.47
7-27-78	2.49	79.51	4.12	71.18
8-22-78	2.46	79.54	4.07	71.23

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 3 of 6).

	Piezometer FP-9		Piezometer FP-10	
Date	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	6.69	71.51	1.89	72.81
6-14-77	6.60	71.60	1.65	73.05
7-20-77	5.59	72.61	0.19	74.51
8-16-77	4.18	74.02	+0.17	74.87
9-15-77	3.54	74.66	+0.11	74.81
10-27-77	3.43	74.77	+0.06	74.76
11-18-77	4.23	73.97	0.02	74.68
12-13-77	3.99	74.21	+0.15	74.85
1-10-78	4.14	74.06	+0.13	74.83
2-13-78	3.29	74.91	+0.20	74.90
3-23-78	3.80	74.40	+0.03	74.73
4-17-78	4.21	73.99	0.72	73.98
5-19-78	2.87	75.33	1.13	73.57
6-23-78	+ .08	78.28	+0.08	74.78
7-27-78	2.97	75.23	+0.15	74.85
8-22-78	2.96	75.24	+0.11	74.81

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

+Water level is above land surface

	Piezometer FP-11		Piezometer FP-12	
Date	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	7.58	60.32	9.80	62.90
6-14-77	7.48	60.42	7.74	64.96
7-20-77	5.76	62.14	5.85	66.85
8-16-77	4.18	63.72	4.20	68.50
9-15-77	2.69	65.21	3.08	69.62
10-27-77	2.77	65.13	3.41	69.29
11-18-77	3.47	64.43	4.14	68.56
12-13-77	3.01	64.89	3.70	69.00
1-10-78	3.11	64.79	3.73	68.97
2-13-78	2.76	65.14	2.82	69.88
3-23-78	2.19	65.71	3.12	69.58
4-17-78	3.94	63.96	4.56	68.14
5-19-78	5.05	62.85	5.58	67.12
6-23-78	1.59	66.31	1.50	71.20
7-27-78	2.35	65.55	2.54	70.16
8-22-78	1.90	66.00	2.46	70.24

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 4 of 6).

	Piezometer FP-13		Piezometer FP-14	
Date	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-25-77	5.23	71.17	7.09	73.61
6-14-77	5.80	70.60	7.21	73.49
7-20-77	3.51	72.89	5.65	75.05
8-16-77	2.12	74.28	3.20	77.65
9-15-77	2.63	73.77	3.64	77.06
10-27-77	2.86	73.54	3.98	76.72
11-18-77	3.80	72.60	4.87	75.83
12-13-77	3.15	73.25	4.56	76.14
1-10-77	3.32	73.08	4.96	76.79
2-13-78	3.10	73.30	4.45	76.25
3-23-78	2.89	73.51	4.18	76.52
4-17-78	4.21	72.19	5.25	75.45
5-19-78	4.74	71.66	5.55	75.15
6-23-78	0.18	76.22	2.26	78.44
7-27-78	2.24	74.16	3.61	77.06
8-22-78	2.44	73.96	3.82	76.88

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

	Piezometer FP-15		Piezometer FP-16	
Date	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	4.11	61.09	9.37	61.33
6-14-77	3.85	61.35	9.22	61.48
7-20-77	2.44	62.76	7.88	62.82
8-16-77	1.16	64.06	1.47	69.53
9-15-77	0.43	64.77	4.68	66.02
10-27-77	0.38	64.82	5.03	65.67
11-18-77	0.85	64.35	5.28	65.42
12-13-77	0.71	64.49	5.19	65.51
1-10-78	0.80	64.40	5.32	65.38
2-13-78	0.55	64.65	4.53	66.17
3-23-78	0.24	64.96	3.72	66.98
3-17-78	1.35	63.85	3.95	66.75
5-19-78	1.41	63.79	5.70	65.00
6-23-78	+0.83	66.03	1.12	69.58
7-27-78	+0.44	65.64	2.57	68.13
8-22-78	+0.84	66.04	2.12	68.58

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

+Water level is above land surface

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 5 of 6).

Date	Piezometer FP-17		Piezometer FP-18	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	5.61	57.29	4.66	66.14
6-14-77	4.57	57.33	3.74	67.06
7-20-77	4.38	58.52	2.14	68.66
8-16-77	3.53	59.37	2.24	68.56
9-15-77	3.35	59.55	2.05	68.75
10-27-77	3.27	59.63	1.86	68.94
11-18-77	3.81	59.09	2.77	68.03
12-13-77	3.58	59.32	2.11	68.69
1-10-78	3.64	59.26	2.40	68.40
2-13-78	3.35	59.55	1.90	68.90
3-23-78	2.10	60.80	2.38	68.42
4-17-78	4.00	58.90	2.23	68.57
5-19-78	4.32	58.58	2.10	68.70
6-23-78	2.28	60.62	0.52	70.28
7-27-78	3.15	59.75	2.03	68.77
8-22-78	3.32	59.58	1.70	69.10

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Date	Piezometer FP-19		Piezometer FP-20	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-24-77	9.49	35.71	8.78	30.22
6-14-77	9.24	35.96	7.97	31.03
7-20-77	7.07	38.13	8.34	30.66
8-16-77	5.70	39.50	7.76	31.24
9-15-77	4.45	40.75	6.05	32.95
10-27-77	5.61	39.59	6.63	32.37
11-18-77	6.52	38.68	6.41	32.59
12-13-77	6.10	39.10	6.66	32.34
1-10-78	6.30	38.90	6.47	32.53
2-13-78	5.53	39.67	6.10	32.90
3-23-78	4.52	40.68	4.43	34.57
4-17-78	6.64	38.56	5.88	33.12
5-19-78	8.09	37.11	6.98	32.02
6-23-78	5.95	39.25	6.42	33.58
7-27-78	5.18	40.02	5.94	33.06
8-22-78	4.20	41.00	4.41	34.59

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Table A-4. MONTHLY WATER LEVELS IN THE SURFICIAL WATER-TABLE AQUIFER, PIEZOMETERS FP-1 THRU FP-20, PT-1 AND PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Concluded, Page 6 of 6).

Date	Piezometer PT-1		Piezometer PT-2	
	Below LSD[1]	Above MSL[2]	Below LSD[1]	Above MSL[2]
5-25-77	4.96	87.74	8.82	64.98
6-14-77	5.52	87.18	9.03	64.77
7-20-77	3.86	88.84	7.67	66.13
8-16-77	1.09	91.61	7.06	66.74
9-15-77	1.90	90.80	7.50	66.30
10-27-77	1.23	91.47	6.85	66.95
11-18-77	2.18	90.52	7.17	66.63
12-13-77	1.47	91.23	6.91	66.89
1-10-78	1.74	90.96	6.97	66.83
2-13-78	1.59	91.11	6.64	67.16
3-23-78	2.29	90.41	6.12	67.68
4-17-78	3.50	89.20	7.12	66.68
5-19-78	3.69	88.74	7.52	66.28
6-23-78	+0.22	92.92	5.37	68.43
7-27-78	1.04	91.66	5.52	68.28
8-22-78	3.29	90.41	5.38	68.42

[1] LSD, Land Surface Datum

[2] MSL, Mean Sea Level

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table A-5. DAILY WATER LEVELS IN THE UPPER UNIT OF THE FLORIDAN AQUIFER (SECONDARY ARTESIAN AQUIFER), WELL FIS-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; SEPTEMBER 1977 - AUGUST 1978 (Continues, Page 1 of 3).

Date	Water Level (in Feet) Below MP	Water Level (in Feet) Above MSL
9-2-77	37.96	44.64
9-3-77	37.73	44.85
9-4-77	37.55	45.05
9-5-77	37.43	45.17
9-6-77	37.35	45.25
9-7-77	37.20	45.40
9-8-77	37.06	45.54
9-9-77	36.92	45.68
9-10-77	36.81	45.79
9-11-77	36.66	45.94
9-12-77	36.54	46.06
9-13-77	36.38	46.22
9-14-77	36.29	46.31
9-15-77	36.22	46.38
9-16-77	36.16	46.44
9-17-77	36.02	46.58
9-18-77	35.94	46.66
9-19-77	35.80	46.80
9-20-77	35.62	46.98
9-21-77	35.50	47.10
9-22-77	35.40	47.20
9-23-77	35.28	47.32
9-24-77	35.19	47.41
9-25-77	35.07	47.53
9-26-77	34.93	47.67
9-27-77	34.96	47.64
9-28-77	—	--
9-29-77	34.82	47.78
9-30-77	34.66	47.94
10-1-77	34.71	47.89
10-2-77	34.60	48.00
10-3-77	34.43	48.17
10-4-77	34.33	48.27
10-5-77	34.45	48.15
10-6-77	34.68	47.92
10-7-77	34.88	47.72
10-8-77	34.71	47.89
10-9-77	34.52	48.08
10-10-77	34.34	48.26
10-11-77	34.24	48.36
10-12-77	34.05	48.55
10-13-77	33.99	48.61
10-14-77	33.91	48.69
10-15-77	34.03	48.57
10-16-77	34.22	48.38
10-17-77	34.42	48.18
10-18-77	34.65	47.95
10-19-77	34.78	47.82
10-20-77	34.98	47.62
10-21-77	35.20	47.40
10-22-77	35.41	47.19
10-23-77	35.55	47.05
10-24-77	35.65	46.95
10-25-77	35.61	46.99
10-26-77	35.45	47.15
10-27-77	35.29	47.31
10-28-77	35.22	47.38
10-29-77	35.15	47.45
10-30-77	35.03	47.57
10-31-77	34.96	47.64
11-1-77	34.85	47.75
11-2-77	34.81	47.79
11-3-77	34.77	47.83
11-4-77	34.73	47.87
11-5-77	34.71	47.89
11-6-77	34.66	47.94
11-7-77	34.63	47.97
11-8-77	34.65	47.95
11-9-77	34.68	47.92
11-10-77	34.70	47.90
11-11-77	34.82	47.78
11-12-77	34.89	47.71
11-13-77	34.98	47.62
11-14-77	35.07	47.53
11-15-77	35.14	47.46
11-16-77	35.20	47.40
11-17-77	35.25	47.35
11-18-77	35.39	47.21
11-19-77	35.54	47.06
11-20-77	35.70	46.90
11-21-77	35.87	46.73
11-22-77	36.18	46.42
11-23-77	36.69	45.91
11-24-77	36.66	45.94
11-25-77	36.56	46.04
11-26-77	36.59	46.01
11-27-77	36.73	45.87
11-28-77	36.78	45.82
11-29-77	36.76	45.84
11-30-77	36.70	45.90
12-1-77	36.69	45.91
12-2-77	36.67	45.93
12-3-77	36.68	45.92
12-4-77	36.57	46.03
12-5-77	36.46	46.14
12-6-77	36.45	46.15
12-7-77	36.55	46.05
12-8-77	36.52	46.08
12-9-77	36.49	46.11
12-10-77	36.28	46.32
12-11-77	36.33	46.27
12-12-77	36.40	46.20
12-13-77	36.27	46.33
12-14-77	36.11	46.49
12-15-77	35.98	46.62
12-16-77	35.86	46.74
12-17-77	35.70	46.90
12-18-77	35.68	46.90
12-19-77	35.61	46.99
12-20-77	35.48	47.12
12-21-77	35.48	47.12
12-22-77	35.52	47.08
12-23-77	35.37	47.23
12-24-77	35.11	47.49
12-25-77	35.00	47.60
12-26-77	35.01	47.59
12-27-77	34.99	47.61
12-28-77	34.92	47.68
12-29-77	34.77	47.83
12-30-77	34.61	47.99
12-31-77	34.48	48.12
1-1-78	34.37	48.23
1-2-78	34.33	48.27
1-3-78	34.31	48.29
1-4-78	34.21	48.39
1-5-78	34.05	48.55
1-6-78	33.93	48.67
1-7-78	33.76	48.84
1-8-78	33.63	48.97
1-9-78	33.63	48.97
1-10-78	33.85	48.75
1-11-78	33.89	48.71
1-12-78	33.62	48.98
1-13-78	33.40	49.20
1-14-78	33.40	49.20
1-15-78	33.46	49.14
1-16-78	33.54	49.06
1-17-78	33.37	49.23
1-18-78	33.27	49.33
1-19-78	33.13	49.47
1-20-78	33.12	49.48
1-21-78	33.21	49.39
1-22-78	33.17	49.43
1-23-78	33.10	49.50
1-24-78	32.88	49.72
1-25-78	32.73	49.87
1-26-78	32.80	49.80
1-27-78	32.83	49.77
1-28-78	32.80	49.80
1-29-78	32.77	49.83
1-30-78	32.75	49.85
1-31-78	32.70	49.90
2-1-78	32.64	49.96
2-2-78	32.58	50.02
2-3-78	32.56	50.04
2-4-78	32.51	50.09
2-5-78	32.44	50.16
2-6-78	32.45	50.15
2-7-78	32.43	50.17
2-8-78	32.26	50.34
2-9-78	32.22	50.38
2-10-78	32.30	50.30
2-11-78	32.33	50.27
2-12-78	32.29	50.31
2-13-78	32.18	50.42
2-14-78	32.22	50.38
2-15-78	32.26	50.34

Table A-5. DAILY WATER LEVELS IN THE UPPER UNIT OF THE FLORIDAN AQUIFER (SECONDARY ARTESIAN AQUIFER), WELL FIS-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; SEPTEMBER 1977 - AUGUST 1978 (Continues, Page 2 of 3).

Date	Water Level (in Feet)	
	Below MP	Above MSL
2-16-78	32.19	50.41
2-17-78	32.16	50.44
2-18-78	32.00	50.60
2-19-78	32.03	50.57
2-20-78	32.08	50.52
2-21-78	32.03	50.57
2-22-78	32.10	50.50
2-23-78	32.13	50.47
2-24-78	32.10	50.50
2-25-78	32.06	50.54
2-26-78	32.02	50.58
2-27-78	31.93	50.67
2-28-78	31.83	50.77
3-1-78	31.81	50.79
3-2-78	31.70	50.90
3-3-78	31.48	51.12
3-4-78	31.53	51.07
3-5-78	31.63	50.97
3-6-78	31.61	50.99
3-7-78	31.51	51.09
3-8-78	31.42	51.18
3-9-78	31.30	51.30
3-10-78	31.20	51.40
3-11-78	31.20	51.40
3-12-78	31.14	51.46
3-13-78	31.05	51.55
3-14-78	31.95	51.65
3-15-78	30.90	51.70
3-16-78	30.81	51.79
3-17-78	30.90	51.70
3-18-78	30.91	51.69
3-19-78	30.84	51.76
3-20-78	30.74	51.86
3-21-78	30.66	51.94
3-22-78	30.58	52.02
3-23-78	30.55	52.05
3-24-78	30.55	52.05
3-25-78	31.04	51.56
3-26-78	31.73	50.87
3-27-78	32.03	50.57
3-28-78	32.36	50.24
3-29-78	32.59	50.01
3-30-78	32.81	49.79
3-31-78	33.06	49.54
4-1-78	33.38	49.22
4-2-78	33.54	49.06
4-3-78	33.84	48.76
4-4-78	34.26	48.34
4-5-78	34.51	48.09
4-6-78	34.69	47.91
4-7-78	35.10	47.50
4-8-78	36.31	46.29
4-9-78	37.40	45.20
4-10-78	38.20	44.40
4-11-78	39.00	43.60
4-12-78	39.78	42.82
4-13-78	40.58	42.02
4-14-78	41.21	41.39
4-15-78	41.56	41.04
4-16-78	42.18	41.02
4-17-78	42.77	39.83
4-18-78	43.19	39.41
4-19-78	43.80	38.80
4-20-78	44.30	38.30
4-21-78	45.23	37.37
4-22-78	45.71	36.89
4-23-78	45.82	36.78
4-24-78	45.08	37.52
4-25-78	46.96	35.64
4-26-78	47.71	34.89
4-27-78	48.30	34.30
4-28-78	48.97	33.63
4-29-78	49.58	33.02
4-30-78	50.20	32.40
5-1-78	50.76	31.84
5-2-78	51.53	31.07
5-3-78	52.25	30.35
5-4-78	52.80	29.80
5-5-78	52.79	29.81
5-6-78	52.50	30.10
5-7-78	51.88	30.72
5-8-78	51.38	31.22
5-9-78	51.02	31.58
5-10-78	50.67	31.93
5-11-78	50.37	32.23
5-12-78	50.11	32.49
5-13-78	49.91	32.69
5-14-78	49.75	32.85
5-15-78	49.74	32.86
5-16-78	49.92	32.68
5-17-78	50.28	32.32
5-18-78	50.61	31.99
5-19-78	49.89	32.71
5-20-78	49.29	33.31
5-21-78	48.85	33.75
5-22-78	48.44	34.16
5-23-78	48.06	34.54
5-24-78	47.72	34.88
5-25-78	47.63	34.97
5-26-78	47.72	34.88
5-27-78	47.85	34.75
5-28-78	47.72	34.88
5-29-78	47.21	35.39
5-30-78	46.76	35.84
5-31-78	46.32	36.28
6-1-78	46.10	36.50
6-2-78	46.00	36.60
6-3-78	45.81	36.79
6-4-78	45.60	37.00
6-5-78	45.46	37.14
6-6-78	45.30	37.30
6-7-78	45.12	37.48
6-8-78	44.89	37.71
6-9-78	44.72	37.88
6-10-78	44.39	38.21
6-11-78	43.95	38.65
6-12-78	43.72	38.88
6-13-78	43.49	39.11
6-14-78	43.29	39.31
6-15-78	43.08	39.52
6-16-78	42.88	39.72
6-17-78	42.64	39.96
6-18-78	42.40	40.20
6-19-78	42.14	40.46
6-20-78	41.91	40.69
6-21-78	41.71	40.89
6-22-78	41.41	41.19
6-23-78	41.16	41.44
6-24-78	40.95	41.65
6-25-78	40.76	41.84
6-26-78	40.57	42.03
6-27-78	40.36	42.24
6-28-78	40.13	42.47
6-29-78	39.88	42.72
6-30-78	39.68	42.92
7-1-78	39.36	43.24
7-2-78	39.16	43.44
7-3-78	38.97	43.63
7-4-78	38.79	43.81
7-5-78	38.63	43.97
7-6-78	38.40	44.20
7-7-78	38.14	44.46
7-8-78	37.96	44.64
7-9-78	37.75	44.85
7-10-78	37.51	45.09
7-11-78	37.30	45.30
7-12-78	37.12	45.48
7-13-78	36.94	45.66
7-14-78	36.75	45.85
7-15-78	36.47	46.13
7-16-78	36.24	46.36
7-17-78	36.08	46.52
7-18-78	35.95	46.65
7-19-78	35.73	46.87
7-20-78	35.60	47.00
7-21-78	35.44	47.16
7-22-78	35.33	47.27
7-23-78	35.17	47.43
7-24-78	35.01	47.59
7-25-78	34.82	47.78
7-26-78	34.62	47.98
7-27-78	34.44	48.16
7-28-78	34.26	48.34
7-29-78	34.07	48.53
7-30-78	33.87	48.73
7-31-78	33.68	48.92
8-1-78	33.48	49.12
8-2-78	33.24	49.36
8-3-78	33.02	49.58
8-4-78	32.87	49.73
8-5-78	32.72	49.88
8-6-78	32.57	50.03
8-7-78	32.44	50.16
8-8-78	32.30	50.30

Table A-5. DAILY WATER LEVELS IN THE UPPER UNIT OF THE FLORIDAN AQUIFER (SECONDARY ARTESIAN AQUIFER), WELL FIS-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; SEPTEMBER 1977 - AUGUST 1978 (Concluded, Page 3 of 3).

Date	Water Level (in Feet) Below MP	Water Level (in Feet) Above MSL
8-9-78	32.12	50.48
8-10-78	31.96	50.64
8-11-78	31.82	50.78
8-12-78	31.65	50.95
8-13-78	31.49	51.11
8-14-78	31.33	51.27
8-15-78	31.22	51.38
8-16-78	31.01	51.59
8-17-78	30.83	51.77
8-18-78	30.69	51.91
8-19-78	30.56	52.04
8-20-78	30.42	52.18
8-21-78	30.27	52.33
8-22-78	30.20	52.40

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table A-6. DAILY WATER LEVELS IN THE LOWER UNIT OF THE FLORIDAN AQUIFER, WELL FIF-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; SEPTEMBER 1977 - AUGUST 1978 (Continues, Page 1 of 2).

Date	Water Level (in Feet)	
	Below MP	Above MSL
9-2-77	37.85	45.24
9-3-77	37.65	45.44
9-4-77	37.45	45.64
9-5-77	37.30	45.79
9-6-77	37.22	45.87
9-7-77	37.10	45.99
9-8-77	36.92	46.17
9-9-77	36.78	46.31
9-10-77	36.66	46.43
9-11-77	36.52	46.57
9-12-77	36.40	46.69
9-13-77	36.22	46.87
9-14-77	36.15	46.94
9-15-77	36.15	46.94
9-16-77	36.08	47.01
9-17-77	35.94	47.15
9-18-77	35.79	47.30
9-19-77	35.66	47.43
9-20-77	35.57	47.52
9-21-77	35.47	47.62
9-22-77	35.38	47.71
9-23-77	35.19	47.18
9-24-77	35.10	47.99
9-25-77	35.00	48.09
9-26-77	34.95	48.14
9-27-77	34.83	48.26
9-28-77	34.85	48.24
9-29-77	34.62	48.47
9-30-77	34.50	48.59
10-1-77	34.49	48.60
10-2-77	34.33	48.76
10-3-77	34.13	48.96
10-4-77	34.16	48.93
10-5-77	33.85	49.24
10-6-77	36.48	46.61
10-7-77	34.95	48.14
10-8-77	34.47	48.62
10-9-77	34.16	48.93
10-10-77	33.98	49.11
10-11-77	33.90	49.19
10-12-77	33.71	49.38
10-13-77	33.69	49.40
10-14-77	33.76	49.33
10-15-77	39.13	43.96
10-16-77	39.93	43.16
10-17-77	40.31	42.78
10-18-77	40.59	42.50
10-19-77	40.77	42.32
10-20-77	41.03	42.06
10-21-77	41.32	41.77
10-22-77	41.58	41.51
10-23-77	41.63	41.46
10-24-77	38.25	44.84
10-25-77	37.25	45.84
10-26-77	35.77	47.32
10-27-77	35.44	47.65
10-28-77	35.38	47.71
10-29-77	35.18	47.91
10-30-77	35.09	48.00
10-31-77	35.03	48.06
11-1-77	34.95	48.14
11-2-77	34.94	48.15
11-3-77	34.97	48.12
11-4-77	34.92	48.17
11-5-77	34.92	48.17
11-6-77	34.85	48.24
11-7-77	34.83	48.26
11-8-77	--	--
11-9-77	--	--
11-10-77	--	--
11-11-77	--	--
11-12-77	--	--
11-13-77	--	--
11-14-77	--	--
11-15-77	--	--
11-16-77	35.75	47.34
11-17-77	35.84	47.25
11-18-77	36.07	47.02
11-19-77	36.30	46.79
11-20-77	36.53	46.56
11-21-77	36.69	46.40
11-22-77	37.09	46.00
11-23-77	37.59	45.50
11-24-77	37.45	45.64
11-25-77	37.35	45.74
11-26-77	37.41	45.68
11-27-77	37.63	45.46
11-28-77	37.67	45.42
11-29-77	37.53	45.56
11-30-77	37.43	45.66
12-1-77	37.41	45.68
12-2-77	37.37	45.72
12-3-77	37.34	45.75
12-4-77	37.15	45.94
12-5-77	37.00	46.09
12-6-77	37.02	46.07
12-7-77	37.14	45.95
12-8-77	37.07	46.02
12-9-77	37.02	46.07
12-10-77	37.02	46.07
12-11-77	36.94	46.15
12-12-77	36.80	46.29
12-13-77	36.65	46.44
12-14-77	36.47	46.62
12-15-77	36.35	46.74
12-16-77	36.20	46.89
12-17-77	35.99	47.10
12-18-77	35.99	47.10
12-19-77	35.93	47.17
12-20-77	35.80	47.29
12-21-77	35.74	47.35
12-22-77	35.84	47.25
12-23-77	35.70	47.39
12-24-77	35.40	47.69
12-25-77	35.18	47.91
12-26-77	35.24	47.85
12-27-77	35.23	47.86
12-28-77	35.14	47.95
12-29-77	35.02	48.07
12-30-77	34.82	48.27
12-31-77	34.71	48.38
1-1-78	34.58	48.51
1-2-78	34.54	48.55
1-3-78	34.52	48.57
1-4-78	34.43	48.66
1-5-78	34.24	48.85
1-6-78	34.12	48.97
1-7-78	34.05	49.04
1-8-78	33.74	49.35
1-9-78	33.83	49.26
1-10-78	34.03	49.06
1-11-78	34.09	49.00
1-12-78	33.82	49.27
1-13-78	33.63	49.46
1-14-78	33.67	49.42
1-15-78	33.79	49.30
1-16-78	33.75	49.34
1-17-78	33.62	49.47
1-18-78	33.47	49.62
1-19-78	33.35	49.74
1-20-78	33.38	49.71
1-21-78	33.51	49.58
1-22-78	33.47	49.62
1-23-78	33.40	49.69
1-24-78	33.08	50.01
1-25-78	32.91	50.18
1-26-78	33.06	50.03
1-27-78	33.12	49.97
1-28-78	33.09	50.00
1-29-78	33.09	50.00
1-30-78	33.08	50.01
1-31-78	33.02	50.07
2-1-78	32.94	50.15
2-2-78	32.87	50.22
2-3-78	32.85	50.24
2-4-78	32.84	50.25
2-5-78	32.74	50.35
2-6-78	32.69	50.40
2-7-78	32.72	50.37
2-8-78	32.52	50.57
2-9-78	32.50	50.59
2-10-78	32.66	50.43
2-11-78	32.71	50.38
2-12-78	32.65	50.44
2-13-78	32.57	50.52

Table A-6. DAILY WATER LEVELS IN THE LOWER UNIT OF THE FLORIDAN AQUIFER, WELL FIF-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; SEPTEMBER 1977 - AUGUST 1978 (Concluded, Page 2 of 2).

Date	Water Level (in Feet)	
	Below MP	Above MSL
2-14-78	32.60	50.49
2-15-78	32.69	50.40
2-16-78	32.63	50.46
2-17-78	32.59	50.50
2-18-78	32.40	50.69
2-19-78	32.44	50.65
2-20-78	32.53	50.56
2-21-78	32.45	50.64
2-22-78	32.56	50.53
2-23-78	32.47	50.62
2-24-78	32.47	50.62
2-25-78	32.42	50.67
2-26-78	32.41	50.68
2-27-78	32.31	50.78
2-28-78	32.16	50.93
3-1-78	32.16	50.93
3-2-78	32.00	51.09
3-3-78	31.79	51.30
3-4-78	31.89	51.20
3-5-78	32.08	51.01
3-6-78	32.06	51.03
3-7-78	31.89	51.20
3-8-78	31.79	51.30
3-9-78	31.56	51.53
3-10-78	31.55	51.54
3-11-78	31.56	51.53
3-12-78	31.51	51.58
3-13-78	31.40	51.69
3-14-78	31.31	51.78
3-15-78	31.26	51.83
3-16-78	31.16	51.93
3-17-78	31.21	51.88
3-18-78	31.32	51.77
3-19-78	31.23	51.86
3-20-78	31.11	51.98
3-21-78	30.97	52.12
3-22-78	30.90	52.19
3-23-78	30.90	52.19
3-24-78	30.95	52.14
3-25-78	31.42	51.67
3-26-78	31.76	51.33
3-27-78	31.99	51.10
3-28-78	32.21	50.88
3-29-78	32.45	50.64
3-30-78	32.68	50.41
3-31-78	33.00	50.09
4-1-78	33.35	49.74
4-2-78	33.62	49.47
4-3-78	34.03	49.06
4-4-78	34.60	48.49
4-5-78	35.08	48.01
4-6-78	35.51	47.58
4-7-78	36.10	46.99
4-8-78	37.30	45.79
4-9-78	38.45	44.64
4-10-78	39.10	43.99
4-11-78	39.81	43.28
4-12-78	40.68	42.41
4-13-78	41.52	41.57
4-14-78	42.39	40.70
4-15-78	42.77	40.32
4-16-78	43.56	39.53
4-17-78	44.11	38.98
4-18-78	44.70	38.39
4-19-78	45.19	37.90
4-20-78	46.01	37.08
4-21-78	47.22	35.87
4-22-78	47.59	35.50
4-23-78	48.02	35.07
4-24-78	48.31	34.78
4-25-78	49.83	33.26
4-26-78	50.48	32.61
4-27-78	51.24	31.85
4-28-78	52.10	30.99
4-29-78	52.58	30.51
4-30-78	53.21	29.88
5-1-78	53.56	29.53
5-2-78	54.04	29.05
5-3-78	54.52	28.57
5-4-78	55.14	27.95
5-5-78	54.91	28.18
5-6-78	54.42	28.67
5-7-78	53.97	29.12
5-8-78	53.46	29.63
5-9-78	53.01	30.08
5-10-78	52.58	30.51
5-11-78	52.14	30.95
5-12-78	51.66	31.43
5-13-78	51.26	31.83
5-14-78	50.94	32.15
5-15-78	50.95	32.14
5-16-78	51.09	32.00
5-17-78	51.17	31.92
5-18-78	51.52	31.57
5-19-78	50.97	32.12
5-20-78	50.45	32.64
5-21-78	50.01	33.08
5-22-78	49.49	33.60
5-23-78	49.07	34.02
5-24-78	48.76	34.33
5-25-78	48.70	34.39
5-26-78	48.98	34.11
5-27-78	48.95	34.14
5-28-78	48.67	34.42
5-29-78	47.94	35.15
5-30-78	47.49	35.60
5-31-78	47.10	35.99
6-1-78	46.85	36.24
6-2-78	46.80	36.29
6-3-78	46.71	36.38
6-4-78	46.52	36.57
6-5-78	46.31	36.78
6-6-78	46.07	37.02
6-7-78	45.83	37.26
6-8-78	45.55	37.54
6-9-78	45.39	37.70
6-10-78	45.03	38.06
6-11-78	44.71	38.38
6-12-78	44.45	38.64
6-13-78	44.18	38.91
6-14-78	43.97	39.12
6-15-78	43.73	39.36
6-16-78	43.53	39.56
6-17-78	43.24	39.85
6-18-78	42.95	40.14
6-19-78	42.70	40.39
6-20-78	42.44	40.65
6-21-78	42.16	40.93
6-22-78	41.86	41.23
6-23-78	41.62	41.47
6-24-78	41.34	41.75
6-25-78	41.14	41.95
6-26-78	40.95	42.14
6-27-78	40.69	42.40
6-28-78	40.43	42.66
6-29-78	40.23	42.86
6-30-78	40.02	43.07
7-1-78	39.78	43.31
7-2-78	39.54	43.55
7-3-78	39.27	43.82
7-4-78	39.10	43.99
7-5-78	38.90	44.19
7-6-78	38.68	44.41
7-7-78	38.41	44.68
7-8-78	38.21	44.88
7-9-78	38.01	45.08
7-10-78	37.76	45.25
7-11-78	37.52	45.57
7-12-78	37.34	45.75
7-13-78	37.13	45.96
7-14-78	36.88	46.21
7-15-78	36.62	46.47
7-16-78	36.39	46.70
7-17-78	36.27	46.82
7-18-78	36.09	47.00
7-19-78	35.84	47.25
7-20-78	35.67	47.42
7-21-78	35.50	47.59
7-22-78	35.37	47.72
7-23-78	35.26	47.83
7-24-78	35.12	47.97
7-25-78	34.93	48.16
7-26-78	34.70	48.39
7-27-78	34.55	48.54
7-28-78	34.39	48.70
7-29-78	34.17	48.92
7-30-78	34.01	49.08
7-31-78	33.80	49.29
8-1-78	33.61	49.48
8-2-78	33.35	49.74
8-3-78	33.14	49.95
8-4-78	32.95	50.14
8-5-78	32.82	50.27
8-6-78	32.70	50.39
8-7-78	32.52	50.57
8-8-78	32.49	50.60
8-9-78	32.22	50.87
8-10-78	32.00	51.09
8-11-78	31.88	51.21
8-12-78	31.72	51.37
8-13-78	31.58	51.51
8-14-78	31.40	51.69
8-15-78	31.26	51.83
8-16-78	31.08	52.01
8-17-78	30.90	52.19
8-18-78	30.82	52.27
8-19-78	30.68	52.41
8-20-78	30.49	52.60
8-21-78	30.36	52.73
8-22-78	30.27	52.82

Source: P.E. LaMoreaux & Associates, Inc. (1978).

APPENDIX B

Table B-1. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature°C	23.0	23.1	26.9	25.0	23.0	23.5	22.5
pH	4.7	4.85	4.9	4.75	4.9	5.1	5.0
Conductivity	82	83	98	95	80	85	80
Residue Filtrable, TDS dried at 180°C	40	62	76	50	56	60	60
Residue Nonfiltrable, TSS dried at 103-105°C	2.0	7.3	19	5.7	46	70	21
Color, PCU	<5.0	5.0	15	14	30	10	20
Turbidity, NTU	4.7	7.1	8.6	7.3	24	18	11
Metals							
Calcjum, Ca	2.9	4.0	4.5	4.4	6.0	13	5.2
Magnesium, Mg	1.3	2.0	2.7	2.5	2.8	2.7	2.3
Sodium, Na	8.8	8.6	9.3	10	7.9	7.9	7.6
Potassium, K	0.42	0.80	2.14	1.88	2.70	1.47	1.60
Iron, Fe	0.90	1.16	1.15	0.13	1.40	2.80	2.27
Nonmetals							
Silica, Si	3.0	3.0	2.0	2.0	3.0	12	3.6
Sulfate, SO$_4$	0.80	1.6	8.0	3.0	8.2	1.4	1.4
Chloride, Cl	18	18	19	19	17	18	20
Fluoride, F	0.10	0.09	0.14	0.20	0.08	0.24	0.21
Bicarboante, HCO$_3$	5.5	22	2.9	5.5	7.3	0.60	49
Carbonate, CO$_3$	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.13	0.46	0.21	0.13	0.08	0.39	0.03
Phosphate, P	0.47	0.62	0.68	0.52	0.44	0.52	0.63
Hydrogen Sulfide, S	<0.10	0.40	0.56	0.59	0.90	0.20	0.43
Alkalinity Total, CaCO$_3$	4.5	3.9	2.4	4.5	6.0	0.50	40
Hardness Total, CaCO$_3$	14	19	24	21	29	49	27
Harndess Noncarbonate, HCO$_3$	0.0	15	22	17	23	38	0.0
Hardness Calcium, CaCO$_3$	7.2	10	11	11	15	33	13
Hardness Magnesium, CaCO$_3$	5.4	7.0	11	10	12	11	9.5

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-7
Physical Examination							
Temperature°C	20.5	20.0	19.0	21.3	22	24.2	25.4
pH	5.15	5.4	5.4	5.12	5.00	4.85	5.6
Conductivity	89	87	81	70	75	94	105
Residue Filtrable, TDS dried at 180°C	56	80	49	44	43	62	81
Residue Nonfiltrable, TSS dried at 103-105°C	55	107	5.0	10	8.5	5.5	15
Color, PCU	25	20	5.0	20	20	25	100
Turbidity, NTU	31	34	16	4.8	5.0	6.3	5.5
Metals							
Calcium, Ca	6.7	3.5	5.4	3.9	3.4	4.0	8.6
Magnesium, Mg	2.4	2.5	2.7	2.2	2.2	2.4	2.7
Sodium, Na	7.6	23	7.3	7.6	7.7	7.2	6.8
Potassium, K	1.78	1.90	3.80	1.68	1.51	2.53	4.42
Iron, Fe	1.24	1.03	1.16	1.18	1.19	1.31	1.21
Nonmetals							
Silica, Si	2.0	2.6	2.7	2.6	2.3	1.7	2.4
Sulfate, SO$_4$	17	1.5	<1.0	1.2	1.7	3.6	1.0
Chloride, Cl	20	20	21	19	20	23	24
Fluoride, F	0.21	0.16	0.15	0.18	0.19	0.12	0.15
Bicarbonate, HCO$_3$	7.3	20	15	7.3	6.7	7.4	21
Carbonate, CO$_3$	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.02	0.04	0.02	0.03	0.38	0.99	0.13
Phosphate, P	1.23	1.65	0.73	0.63	0.08	0.17	0.76
Hydrogen Sulfide, S	<0.01	0.37	0.32	0.35	0.30	0.27	0.23
Alkalinity Total, CaCO$_3$	6.0	16	12	6	5.5	6.1	17
Hardness Total, CaCO$_3$	29	21	27	21	20	22	35
Hardness Noncarbonate, HCO$_3$	23	4.9	15	15	14	16	17
Hardness Calcium, CaCO$_3$	17	8.7	14	9.7	8.5	10	22
Hardness Magnesium, CaCO$_3$	9.9	10	11	9.1	9.1	9.9	11

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-2. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-4 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	24.0	24.7	26.7	25.2	25.2	25.0	22.2
pH	5.8	6.0	5.5	5.70	5.1	6.0	5.6
Conductivity	200	238	200	222	187	214	175
Residue Filtrable, TDS dried at 180°C	125	197	237	230	130	149	125
Residue Nonfiltrable, TSS dried at 103-105°C	7.5	1.0	12.5	24	71	47	5.5
Color, PCU	10	32	300	300	175	250	250
Turbidity, NTU	15	5.2	9.8	5.1	40	17	4.4
Metals							
Calcium, Ca	19	21	27	36	32	30	29
Magnesium, Mg	6.0	7.0	2.5	3.3	3.2	3.5	2.4
Sodium, Na	15	21	16	16	17	17	16
Potassium, K	0.74	0.90	0.52	0.85	0.47	0.53	0.85
Iron, Fe	4.00	1.01	2.34	0.55	5.30	4.40	2.05
Nonmetals							
Silica, Si	13.0	9.0	6.0	7.0	6.0	6.1	4.4
Sulfate, SO_4	1.0	17.6	10.5	5.0	8.8	10	7.0
Chloride, Cl	20	34	18	19	29	32	25
Fluoride, F	0.47	0.35	0.70	0.90	0.73	0.72	0.78
Bicarbonate, HCO_3	79	81	54	67	33	38	49
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.49	0.32	0.21	0.25	0.12	0.16	0.04
Phosphate, P	2.38	1.52	1.48	2.80	1.00	0.98	0.70
Hydrogen Sulfide, S	0.12	0.24	1.80	0.59	<0.01	0.10	0.07
Alkalinity Total, $CaCO_3$	69	38	44	55	27	31	40
Hardness Total, $CaCO_3$	80	78	84	104	103	97	87
Hardness Noncarbonate, HCO_3	11	40	40	50	75	66	47
Hardness Calcium, $CaCO_3$	48	52	69	90	80	75	73
Hardness Magnesium, $CaCO_3$	25	24	10	13	13	14	9.4

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	21.8	23	21.4	22.5	23.0	25.1	25.8
pH	5.55	6.6	5.80	5.81	5.80	5.28	6.05
Conductivity	188	199	188	187	165	168	210
Residue Filtrable, TDS dried at 180°C	231	251	120	199	186	205	244
Residue Nonfiltrable, TSS dried at 103-105°C	16	11	1.0	3.0	14	3	39
Color, PCU	300	250	600	100	300	400	300
Turbidity, NTU	23	9.0	1.8	2.7	12	4.0	12
Metals							
Calcium, Ca	30	31	30	27	25	22	36
Magnesium, Mg	2.4	2.7	2.4	2.6	2.7	1.9	2.7
Sodium, Na	15	25	14	14	14	14	13
Potassium, K	0.64	0.70	0.81	0.85	0.72	0.42	0.55
Iron, Fe	3.72	2.73	4.52	3.82	5.39	1.00	4.36
Nonmetals							
Silica, Si	3.8	5.1	5.2	5.5	6.8	4.4	5.5
Sulfate, SO_4	5.0	5.0	<1.0	<1.0	<1.0	11.6	5.0
Chloride, Cl	23	25	23	23	22	25	24
Fluoride, F	0.76	0.78	0.78	0.86	0.91	0.70	0.84
Bicarbonate, HCO_3	61	52	62	57	65	39	74
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.05	0.02	<0.01	0.32	0.21	1.60	0.01
Phosphate, P	1.46	1.15	1.14	1.24	1.67	0.54	1.40
Hydrogen Sulfide, S	0.16	0.16	0.34	0.11	0.22	0.30	0.27
Alkalinity Total, $CaCO_3$	50	43	51	47	53	32	60
Hardness Total, $CaCO_3$	92	94	93	85	83	64	108
Hardness Noncarbonate, HCO_3	42	51	42	38	30	32	48
Hardness Calcium, $CaCO_3$	75	78	75	67	62	54	89
Hardness Magnesium, $CaCO_3$	9.9	11	9.9	11	11	7.8	11

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-3. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-6 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	24.6	24.2	27.2	25.1	27.5	24.0	22.5
pH	5.9	5.45	4.6	6.12	4.9	5.3	5.5
Conductivity	163	162	1800	388	950	256	421
Residue Filtrable, TDS dried at 180°C	96	117	1262	307	660	180	300
Residue Nonfiltrable, TSS dried at 103-105°C	4.0	5.0	35	13	0.27	32	4.0
Color, PCU	5	10	45	0	75	40	30
Turbidity, NTU	15	13	19	5.0	9.0	9.0	1.2
Metals							
Calcium, Ca	16	18	115	24	89	11	37
Magnesium, Mg	3.8	5.0	112	26	82	16	41
Sodium, Na	6.9	7.0	30	14	25	7.2	13
Potassium, K	0.35	6.00	47	14	24	7.70	16
Iron, Fe	1.7	2.03	1.68	0.03	0.44	2.00	0.33
Nonmetals							
Silica, Si	9.0	7.0	17	9.0	13.0	8.7	8.9
Sulfate, SO_4	3.7	9.2	310	3.4	300	27	125
Chloride, Cl	19	19	166	36	116	26	53
Fluoride, F	0.36	0.35	0.35	0.80	0.27	0.67	0.72
Bicarbonate, HCO_3	41	84	13	36	48	32	30
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.26	0.82	0.54	5.35	0.98	1.58	5.60
Phosphate, P	2.83	2.89	1.28	1.83	0.66	1.67	1.60
Hydrogen Sulfide, S	0.04	0.30	<0.01	0.40	0.86	<0.01	0.53
Alkalinity Total, $CaCO_3$	34	32	11	29	39	26	25
Hardness Total, $CaCO_3$	58	66	752	162	560	97	260
Hardness Noncarbonate, HCO_3	25	34	747	138	520	71	235
Hardness Calcium, $CaCO_3$	40	45	288	61	220	28	91
Hardness Magnesium, $CaCO_3$	16	17	461	107	240	66	168

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	21.8	20.0	20.7	22.0	21.5	25.2	25.7
pH	5.6	5.2	5.7	5.75	5.8	4.7	5.8
Conductivity	610	947	333	133	135	1415	802
Residue Filtrable, TDS dried at 180°C	476	744	255	114	112	1095	734
Residue Nonfiltrable, TSS dried at 103-105°C	7.0	32	<0.50	5.0	5.0	21	8.0
Color, PCU	30	100	50	50	30	80	50
Turbidity, NTU	3.9	10	1.1	5.0	4.3	4.5	2.5
Metals							
Calcium, Ca	36	59	18	10	12	88	52
Magnesium, Mg	41	65	20	9.4	9.5	90	52
Sodium, Na	13	25	9.0	6.3	6.5	20	15
Potassium, K	17	26	13	6.00	4.40	45	22
Iron, Fe	0.25	0.49	0.14	0.44	0.60	0.33	0.26
Nonmetals							
Silica, Si	9.0	11.6	8.9	8.4	9.2	13	10.0
Sulfate, SO_4	100	174	56	7.7	3.6	266	134
Chloride, Cl	63	97	37	24	11	156	92
Fluoride, F	0.59	0.52	0.51	0.56	0.68	0.60	0.49
Bicarbonate, HCO_3	25	15	33	39	41	9.1	28
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	1.00	0.17	1.84	0.13	0.06	0.76	1.04
Phosphate, P	1.18	0.37	1.02	1.28	1.53	0.10	1.14
Hydrogen Sulfide, S	0.11	0.37	0.15	0.10	0.15	0.04	0.04
Alkalinity Total, $CaCO_3$	20	12	27	32	34	7.5	23
Hardness Total, $CaCO_3$	259	415	129	64	71	590	343
Hardness Noncarbonate, HCO_3	239	403	102	32	37	583	321
Hardness Calcium, $CaCO_3$	90	147	45	25	31	220	130
Hardness Magnesium, $CaCO_3$	168	268	84	39	39	370	213

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-4. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-8 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature°C	23.5	23.2	25.0	25.0	22.5	23.8	23.8
pH	6.7	6.3	6.4	5.7	6.5	6.3	6.7
Conductivity	600	490	510	348	470	450	410
Residue Filtrable, TDS dried at 180°C	352	363	364	273	329	311	251
Residue Nonfiltrable, TSS dried at 103-105°C	29	20	10	24	52	44	7.5
Color, PCU	10	12	40	225	80	80	60
Turbidity, NTU	18	14	5	11	26	24	12
Metals							
Calcium, Ca	50	56	49	34	48	50	42
Magnesium, Mg	27	31	28	17	26	28	23
Sodium, Na	22	22	23	22	22	22	21
Potassium, K	0.39	0.70	3.60	8.60	6.20	0.87	5.90
Iron, Fe	0.90	0.85	1.16	0.21	6.20	5.90	3.10
Nonmetals							
Silica, Si	27	21	24	13	18	17	15
Sulfate, SO_4	1.8	10	17	35	50	23	30
Chloride, Cl	34	35	43	30	35	38	38
Fluoride, F	0.50	0.52	0.89	1.00	1.10	1.30	1.15
Bicarbonate, HCO_3	302	328	255	121	186	321 ✓	206
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.42	0.37	0.45	0.13	0.06	0.13	0.03
Phosphate, P	1.37	1.28	0.55	1.13	1.40	1.42	0.58
Hydrogen Sulfide, S	0.00	0.16	0.84	0.46	0.30	0.27	0.17
Alkalinity Total, $CaCO_3$	248	235	209	100	153	175	169
Hardness Total, $CaCO_3$	240	250	241	158	238	251	359
Hardness Noncarbonate, HCO_3	0.0	19	32	58	85	75	190
Hardness Calcium, $CaCO_3$	125	140	123	86	120	125	104
Hardness Magnesium, $CaCO_3$	113	108	116	72	107	115	94

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-27-78
Physical Examination							
Temperature°C	23.0	23.0	23.5	22.8	23.0	25.5	23.6
pH	6.6	6.4	6.38	6.4	6.2	5.1	6.2
Conductivity	418	428	352	350	325	301	412
Residue Filtrable, TDS dried at 180°C	346	310	320	300	253	317	419
Residue Nonfiltrable, TSS dried at 103-105°C	6.5	26	0.50	2.5	6	16	16
Color, PCU	40	150	100	75	40	600	500
Turbidity, NTU	10	12	1.6	2.5	4.5	7.3	3.9
Metals							
Calcium, Ca	42	38	42	42	40	24	43
Magnesium, Mg	24	21	22	23	22	11	18
Sodium, Na	21	25	22	21	23	18	23
Potassium, K	5.30	7.30	9.60	5.40	3.07	13	8.65
Iron, Fe	4.00	6.35	1.89	3.28	2.32	3.85	2.97
Nonmetals							
Silica, Si	15	15	13	17	15	11	13
Sulfate, SO_4	30	35	48	20	27	58	50
Chloride, Cl	41	42	40	35	23	40	48
Fluoride, F	1.10	1.10	1.20	1.45	1.30	1.15	1.15
Bicarbonate, HCO_3	176	144	163	196	171	25	115
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.06	0.15	1.84	0.07	0.08	1.42	0.04
Phosphate, P	0.70	1.09	1.02	0.35	0.36	2.40	0.57
Hydrogen Sulfide, S	<0.01	0.51	0.13	0.07	0.15	0.12	0.15
Alkalinity Total, $CaCO_3$	145	118	114	161	140	20	94
Hardness Total, $CaCO_3$	211	194	197	206	195	112	185
Hardness Noncarbonate, HCO_3	66	76	63	45	55	92	91
Hardness Calcium, $CaCO_3$	106	95	105	104	100	60	106
Hardness Magnesium, $CaCO_3$	98	87	89	96	91	45	74

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-5. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-10 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	26.0	23.0	23.3	23.5	22.5	24.0	22.8
pH	6.2	7.1	6.3	6.30	6.1	6.7	5.6
Conductivity	270	248	258	243	243	246	210
Residue Filtrable, TDS dried at 180°C	199	193	200	202	170	187	145
Residue Nonfiltrable, TSS dried at 103-105°C	99	31	57	462	346	194	45
Color, PCU	10	15	15	12	20	20	20
Turbidity, NTU	37	16	27	555	148	60	47
Metals							
Calcium, Ca	27	28	27	60	40	63	37
Magnesium, Mg	13	16	15	18	17	18	16
Sodium, Na	11	10	11	12	10	10	9.4
Potassium, K	0.65	0.70	0.69	0.85	0.81	0.87	0.95
Iron, Fe	1.20	0.89	1.15	0.40	1.30	3.60	0.70
Nonmetals							
Silica, Si	27	22	28	32	27	27	23
Sulfate, SO_4	0.6	1.0	<1.0	<1.0	4	2.8	1.6
Chloride, Cl	11	10	11	11	11	11	12
Fluoride, F	0.23	0.22	0.44	0.60	0.42	0.38	0.49
Bicarbonate, HCO_3	158	168	155	145	140	151	148
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.92	0.07	0.10	0.49	0.35	0.17	0.08
Phosphate, P	4.04	1.78	2.35	1.20	2.83	2.30	2.25
Hydrogen Sulfide, S	<0.10	0.18	0.50	0.26	0.36	0.03	0.07
Alkalinity Total, $CaCO_3$	130	126	127	119	115	123	121
Hardness Total, $CaCO_3$	124	128	130	223	172	238	158
Hardness Noncarbonate, HCO_3	0.0	2.0	3.4	104	57	114	37
Hardness Calcium, $CaCO_3$	67	70	66	149	100	157	92
Hardness Magnesium, $CaCO_3$	55	56	62	73	70	74	65

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	23.0	23.0	21.5	23.9	23.0	24.0	23.5
pH	6.60	6.6	5.82	6.45	6.4	6.02	6.75
Conductivity	210	256	253	213	200	178	259
Residue Filtrable, TDS dried at 180°C	160	192	164	182	176	262	176
Residue Nonfiltrable, TSS dried at 103-105°C	53	71	10	15	26	35	16
Color, PCU	25	10	20	25	25	10	20
Turbidity, NTU	31	28	4.1	7.0	10	13	2.8
Metals							
Calcium, Ca	37	26	42	28	30	28	29
Magnesium, Mg	15.7	16	22	16	16	16	15
Sodium, Na	9.5	23	22	9.7	9.7	9.4	9.6
Potassium, K	0.80	0.70	9.6	0.88	0.78	0.79	0.77
Iron, Fe	0.55	0.91	1.89	0.59	0.86	0.85	0.55
Nonmetals							
Silica, Si	22	24	13	23	24	21	21
Sulfate, SO_4	0.9	2.6	<1.0	<1.0	1.4	<1.0	<1.0
Chloride, Cl	12	12	12	12	40	14	14
Fluoride, F	0.46	0.46	0.47	0.49	0.48	0.45	0.46
Bicarbonate, HCO_3	155.2	152	151	151	152	157	154
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.01	0.13	<0.01	0.64	0.04	0.72	0.09
Phosphate, P	2.00	0.93	1.01	0.86	1.26	1.36	1.03
Hydrogen Sulfide, S	0.05	0.06	0.10	<0.01	0.10	0.11	0.08
Alkalinity Total, $CaCO_3$	127	125	124	124	125	128	126
Hardness Total, $CaCO_3$	156	130	197	134	140	135	133
Hardness Noncarbonate, HCO_3	29	5.4	73	10	15	6.5	6.8
Hardness Calcium, $CaCO_3$	91	64	105	69	75	69	72
Hardness Magnesium, $CaCO_3$	65	65	89	64	64	64	60

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-6. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-12 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	25.0	26.0	27.2	26.0	29.5	24.9	23.5
pH	5.6	5.1	5.0	5.6	4.8	4.9	5.6
Conductivity	102	98	108	120	80	78	80
Residue Filtrable, TDS dried at 180°C	54	64	72	84	56	55	56
Residue Nonfiltrable, TSS dried at 103-105°C	28	16	7.0	36	68	47	14
Color, PCU	37	18	5.0	11	20	25	25
Turbidity, NTU	10	23	9.5	35	35	18	17
Metals							
Calcium, Ca	7.1	8.0	8.9	14	9.0	3.0	6.8
Magnesium, Mg	1.6	2.0	2.4	4.6	1.8	1.3	1.7
Sodium, Na	7.4	7.1	7.7	10	6.6	6.5	6.2
Potassium, K	0.06	0.20	0.30	0.62	0.30	0.25	0.38
Iron, Fe	3.70	3.83	1.13	1.31	6.00	4.40	4.13
Nonmetals							
Silica, Si	3.0	3.0	5.0	4.0	3.0	3.0	2.7
Sulfate, SO_4	8.5	11	12	14	8.2	10	8.8
Chloride, Cl	10	10	11	11	9.0	11	10
Fluoride, F	0.18	0.21	0.41	0.50	0.14	0.26	0.32
Bicarbonate, HCO_3	18	43	16	23	<1.0	0.24	6.1
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.62	0.69	0.23	0.88	0.12	0.09	0.04
Phosphate, P	1.63	1.54	0.88	0.85	1.87	0.33	1.00
Hydrogen Sulfide, S	0.10	0.29	0.40	0.44	0.40	<0.01	0.17
Alkalinity Total, $CaCO_3$	15	10	13	19	<1.0	0.2	5.0
Hardness Total, $CaCO_3$	31	34	34	57	41	26	31
Hardness Noncarbonate, HCO_3	16	24	21	37	41	26	26
Hardness Calcium, $CaCO_3$	18	20	22	36	23	13	17
Hardness Magnesium, $CaCO_3$	7	7	10	19	7.4	5.4	7

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-27-78
Physical Examination							
Temperature °C	22.2	21.5	21.8	22.1	23.5	25.2	25.0
pH	5.9	5.6	5.7	5.4	5.3	5.0	5.6
Conductivity	72	77	91	69	70	68	75
Residue Filtrable, TDS dried at 180°C	56	57	70	39	55	51	45
Residue Nonfiltrable, TSS dried at 103-105°C	33	83	12	14	25	35	29
Color, PCU	25	30	30	30	40	25	30
Turbidity, NTU	30	32	12	12	22	18	15
Metals							
Calcium, Ca	7.0	5.8	9.7	4.7	6.4	6.6	6.2
Magnesium, Mg	1.7	2.0	3.1	1.2	1.4	1.7	3.3
Sodium, Na	5.9	20	6.7	6.0	5.9	5.8	6.2
Potassium, K	0.28	0.30	0.40	0.30	0.33	0.64	0.96
Iron, Fe	4.12	5.90	0.97	4.28	4.68	3.56	4.28
Nonmetals							
Silica, Si	2.4	3.2	2.8	3.3	4.2	3.7	5.5
Sulfate, SO_4	8.5	9.4	9.0	8.8	9.0	12	4.0
Chloride, Cl	9.4	10	11	9.7	14	10	6.8
Fluoride, F	0.29	0.34	0.43	0.25	0.30	0.29	0.52
Bicarbonate, HCO_3	10	12	32	6.1	13	7.3	25
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.03	<0.01	0.81	0.22	0.18	0.97	0.06
Phosphate, P	1.52	1.73	0.62	0.39	0.94	0.54	1.29
Hydrogen Sulfide, S	0.05	<0.01	0.04	0.09	0.12	0.08	0.08
Alkalinity Total, $CaCO_3$	8.5	10	26	5	11	6.0	7.0
Hardness Total, $CaCO_3$	32	33	39	24	30	30	37
Hardness Noncarbonate, HCO_3	24	23	13	19	19	24	30
Hardness Calcium, $CaCO_3$	17	15	24	12	16	17	16
Hardness Magnesium, $CaCO_3$	7	8	13	5	5.8	7	14

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-7. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-14 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature°C	24.9	25.2	27.2	26.0	27.5	24.0	23.2
pH	5.8	5.7	5.7	5.5	4.9	6.1	5.3
Conductivity	121	111	82	95	87	90	79
Residue Filtrable, TDS dried at 180°C	75	78	75	66	60	63	55
Residue Nonfiltrable, TSS dried at 103-105°C	63	13	38	43	86	35	16
Color, PCU	73	12	15	19	15	25	25
Turbidity, NTU	12	40	50	45	42	22	25
Metals							
Calcium, Ca	11	10	7.8	12	16	4.0	8.3
Magnesium, Mg	2.5	3.0	2.7	3.2	3.0	2.6	1.8
Sodium, Na	9.2	7.4	7.2	7.0	6.2	6.6	6.4
Potassium, K	0.21	0.20	0.18	0.17	0.15	0.21	0.37
Iron, Fe	5.00	6.72	4.16	0.71	5.20	2.20	4.22
Nonmetals							
Silica, Si	9.0	6.0	6.0	6.0	6.0	8.5	5.5
Sulfate, SO_4	5.0	12	10	1.0	5.0	5.6	5.0
Chloride, Cl	5.3	4.7	8.7	5.4	4.5	5.3	9.0
Fluoride, F	0.37	0.33	0.48	0.60	0.34	0.76	0.66
Bicarbonate, HCO_3	45	60	18	23	18	29	18
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	1.28	0.09	0.21	0.54	0.07	0.03	0.04
Phosphate, P	4.43	3.24	2.85	4.15	4.00	2.78	2.75
Hydrogen Sulfide, S	0.0	0.38	0.52	0.12	0.44	0.09	<0.01
Alkalinity Total, $CaCO_3$	37	28	16	19	15	24	15
Hardness Total, $CaCO_3$	76	47	38	45	49	27	36
Hardness Noncarbonate, HCO_3	50	19	22	26	34	2.5	21
Hardness Calcium, $CaCO_3$	26	25	20	30	40	10	21
Hardness Magnesium, $CaCO_3$	10	10	11	13	12	11	7.4

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature°C	24.0	23.5	21.0	23.0	24.5	25.5	25.6
pH	5.6	5.7	6.1	5.7	5.7	5.1	5.9
Conductivity	89	79	84	78	80	62	77
Residue Filtrable, TDS dried at 180°C	70	80	64	59	64	58	68
Residue Nonfiltrable, TSS dried at 103-105°C	17	47	1.0	8.5	11	120	31
Color, PCU	30	30	30	30	40	30	25
Turbidity, NTU	24	70	5.3	8.5	17	77	25
Metals							
Calcium, Ca	9.1	7.6	8.6	9.0	7.1	8.6	8.2
Magnesium, Mg	2.1	2.1	2.7	2.2	1.5	1.6	2.0
Sodium, Na	6.5	21	5.9	6.4	6.9	5.6	5.2
Potassium, K	0.14	0.20	0.17	0.15	0.17	0.25	0.22
Iron, Fe	3.53	6.82	1.36	2.40	6.53	5.75	4.26
Nonmetals							
Silica, Si	5.7	6.7	5.6	5.7	6.7	10	5.5
Sulfate, SO_4	4.4	5.4	<1.0	6.4	7.0	6.4	4.0
Chloride, Cl	12	6.6	6.6	6.0	8.3	7.4	6.8
Fluoride, F	0.70	0.64	0.67	0.76	0.72	0.47	0.52
Bicarbonate, HCO_3	30	26	28	28	24	17	25
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.04	0.12	0.02	0.18	0.11	0.44	0.06
Phosphate, P	2.80	4.20	2.15	2.20	2.40	2.30	2.60
Hydrogen Sulfide, S	<0.01	<0.01	----	0.03	0.15	0.12	0.12
Alkalinity Total, $CaCO_3$	25	21	23	23	20	14	20
Hardness Total, $CaCO_3$	38	40	35	36	36	38	36
Hardness Noncarbonate, HCO_3	13	19	12	13	16	25	16
Hardness Calcium, $CaCO_3$	23	19	22	23	18	22	21
Hardness Magnesium, $CaCO_3$	8.6	8.6	11	9.1	6.2	6.6	8.2

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-8. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER FP-17 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-16-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	24.0	23.5	26.0	24.8	26.0	22.9	22.1
pH	6.29	6.3	6.7	5.65	4.8	5.9	5.8
Conductivity	141	126	150	123	85	118	108
Residue Filtrable, TDS dried at 180°C	86.0	93	135	54	59	82	75
Residue Nonfiltrable, TSS dried at 103-105°C	37.5	8.0	12.5	28	68	20	19
Color, PCU	<5.0	12	20	48	30	30	30
Turbidity, NTU	23.5	7.7	10	20	18	17	9.1
Metals							
Calcium, Ca	16	17	19	19	17	17	15
Magnesium, Mg	3.9	4.0	6.4	6.4	4.6	5.2	4.8
Sodium, Na	6.1	6.1	5.4	6.0	3.9	5.2	5.2
Potassium, K	0.48	0.50	2.02	1.53	0.80	1.12	1.20
Iron, Fe	0.6	0.67	0.36	0.07	1.9	1.2	1.77
Nonmetals							
Silica, Si	8.0	7	6.0	6.0	5.0	8.4	5.9
Sulfate, SO$_4$	8.0	8.2	24.0	9.5	8.0	8.0	7.0
Chloride, Cl	11	11	4.7	6.7	8.5	15	13
Fluoride, F	0.45	0.44	0.52	0.50	0.15	0.68	0.72
Bicarbonate, HCO$_3$	49.5	73	40.5	34	6.1	34	36
Carbonate, CO$_3$	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.30	0.22	2.20	0.68	0.08	0.04	0.01
Phosphate, P	3.01	1.71	1.35	2.45	1.78	2.23	1.60
Hydrogen Sulfide, S	0.12	0.30	0.30	0.40	0.50	0.10	0.70
Alkalinity Total, CaCO$_3$	41	37	33	28	5.0	28	30
Hardness Total, CaCO$_3$	56	58	73	73	65	66	59
Hardness Noncarbonate, HCO$_3$	16	21	40	45	60	38	29
Hardness Calcium, CaCO$_3$	39	43	46	46	43	43	36
Hardness Magnesium, CaCO$_3$	16	24	26	26	29	21	20

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	22.0	22.0	22.2	22.0	23.0	24.5	23.0
pH	6.0	6.3	5.95	5.95	5.9	5.05	6.0
Conductivity	120	130	85	99	75	70	70
Residue Filtrable, TDS dried at 180°C	94	86	70	78	54	70	71
Residue Nonfiltrable, TSS dried at 103-105°C	3.5	40	36	50	16	36	56
Color, PCU	25	25	30	25	25	70	50
Turbidity, NTU	3.2	16	30	31	9.3	15	22
Metals							
Calcium, Ca	14	14	17	18	17	9.7	14
Magnesium, Mg	4.6	4.8	4.2	4.5	4.3	2.8	3.0
Sodium, Na	5.3	20	3.2	4.8	5.4	2.2	2.4
Potassium, K	0.98	0.70	0.82	0.91	0.71	0.45	0.41
Iron, Fe	0.38	0.74	0.56	1.58	0.99	1.04	1.32
Nonmetals							
Silica, Si	5.9	9.0	5.8	12	9.5	5.5	7.8
Sulfate, SO$_4$	8.0	9.0	8.8	10	9.0	11.6	7.0
Chloride, Cl	13	13	8.5	12	10	5.4	7.9
Fluoride, F	0.74	0.78	0.52	0.60	0.74	0.29	0.42
Bicarbonate, HCO$_3$	40	45	29	33	39	18	23
Carbonate, CO$_3$	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.02	0.05	0.05	0.41	0.12	0.35	0.02
Phosphate, P	1.36	1.91	2.08	2.35	1.45	1.08	1.29
Hydrogen Sulfide, S	<0.01	0.11	0.07	0.17	0.10	0.18	0.15
Alkalinity Total, CaCO$_3$	33	37	24	27	32	15	19
Hardness Total, CaCO$_3$	55	57	61	19	61	38	49
Hardness Noncarbonate, HCO$_3$	22	20	37	39	29	23	30
Hardness Calcium, CaCO$_3$	36	36	43	66	41	24	35
Hardness Magnesium, CaCO$_3$	19	20	17	45	18	12	12

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-9. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER PT-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-16-77	9-15-77	10-27-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	23.0	21.2	24.6	23.8	21.0	23.0	22.1
pH	5.9	5.07	5.6	5.53	5.3	5.2	5.3
Conductivity	138	155	152	100	110	92	84
Residue Filtrable, TDS dried at 180°C	86	79	104	87	77	64	59
Residue Nonfiltrable, TSS dried at 103-105°C	40	1.0	6.7	3.3	3.5	73	9.0
Color, PCU	5.0	15	10	10	25	20	10
Turbidity, NTU	27	8.2	10	5.5	7.2	30	7.5
Metals							
Calcium, Ca	14	14	16	11	15	12	9.6
Magnesium, Mg	5.6	5	7.1	3.5	6.9	3.4	3.2
Sodium, Na	5.3	4.8	5.4	7.0	5.1	4.8	4.5
Potassium, K	0.32	0.30	0.31	0.40	1.20	0.34	0.49
Iron, Fe	1.40	1.15	1.56	0.13	1.50	2.00	1.17
Nonmetals							
Silica, Si	3.0	2	3.0	3.0	3.0	4.2	2.7
Sulfate, SO_4	3.6	2.6	5.0	4.0	5.8	2.2	3.0
Chloride, Cl	9.4	9.5	9.2	9.9	10.0	42	11
Fluoride, F	0.23	0.02	0.41	0.40	0.21	0.47	0.40
Bicarbonate, HCO_3	60	70	67	27	136	29	27
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.61	0.02	0.05	0.30	0.40	0.43	1.34
Phosphate, P	4.27	1.30	1.40	1.28	0.96	1.30	<0.01
Hydrogen Sulfide, S	0.55	0.60	0.46	0.72	0.62	0.40	0.53
Alkalinity Total, $CaCO_3$	50	42	55	23	111	24	22
Hardness Total, $CaCO_3$	60	54	72	43	69	48	39
Hardness Noncarbonate, HCO_3	11	12	17	20	0.0	24	17
Hardness Calcium, $CaCO_3$	35	35	40	28	38	30	24
Hardness Magnesium, $CaCO_3$	23	17	29	15	28	14	13

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	22.5	21.0	20.5	22.2	23	23.0	23.8
pH	5.56	5.7	5.67	5.55	5.30	5.55	5.70
Conductivity	85	79	70	72	75	116	82
Residue Filtrable, TDS dried at 180°C	67	59	36	47	51	76	51
Residue Nonfiltrable, TSS dried at 103-105°C	1.5	6.8	8.3	15	9.5	3	10
Color, PCU	10	25	15	20	20	25	40
Turbidity, NTU	3.7	3.7	0.55	8.5	5.6	2.5	6.0
Metals							
Calcium, Ca	8.1	6.9	7.3	10	8.5	11	8.6
Magnesium, Mg	2.5	2.3	2.2	2.5	2.3	3.7	1.9
Sodium, Na	4.6	18	4.4	4.3	4.3	4.5	4.7
Potassium, K	0.36	0.30	0.31	0.30	0.29	0.60	0.34
Iron, Fe	0.95	0.92	0.91	1.20	1.11	1.06	1.15
Nonmetals							
Silica, Si	2.2	1.8	2.2	3.2	2.7	2.2	2.6
Sulfate, SO_4	2.5	2.5	3.4	3.6	2.4	6.8	3.4
Chloride, Cl	10.9	11.4	11.4	11	11.6	14	13
Fluoride, F	0.37	0.34	0.38	0.39	0.41	0.39	0.36
Bicarbonate, HCO_3	26	15	26	21	21	40	23
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.01	<0.01	0.02	0.23	0.06	0.18	0.04
Phosphate, P	1.10	0.94	0.83	0.75	0.84	0.80	1.18
Hydrogen Sulfide, S	0.47	0.53	0.27	0.10	0.68	0.52	0.41
Alkalinity Total, $CaCO_3$	21	12	21	17	17	32	19
Hardness Total, $CaCO_3$	32	28	29	38	33	45	31
Hardness Noncarbonate, HCO_3	11	16	7.9	21	16	12	13
Hardness Calcium, $CaCO_3$	20	17	18	26	21	28	22
Hardness Magnesium, $CaCO_3$	10	9.5	9.1	10	9.5	15	7.8

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-10. MONTHLY CHEMICAL ANALYSES OF SURFICIAL AQUIFER WATER SAMPLES FROM PIEZOMETER PT-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-16-77	9-15-77	10-17-77	11-18-77	12-13-77
Physical Examination							
Temperature °C	25.0	24.8	26.8	27.0	27.5		23.5
pH	5.8	5.3	5.1	5.81	5.6		5.35
Conductivity	115	124	88	113	110		88
Residue Filtrable, TDS dried at 180°C	67.0	54	69	57	65		61
Residue Nonfiltrable, TSS dried at 103-105°C	3.0	4.3	4.0	1.7	7.0	SEE SURFICIAL AQUIFER PUMPING TEST	4
Color, PCU	10	10	10	12	20		20
Turbidity, NTU	12	10	9.5	14	6.6		11
Metals							
Calcium, Ca	9.5	7.0	7.7	12	11		8.1
Magnesium, Mg	3.3	2.0	2.4	4.5	4.7		2.7
Sodium, Na	5.3	4.9	5.2	6.0	4.8		4.4
Potassium, K	0.41	0.40	0.42	0.57	0.60		0.56
Iron, Fe	1.6	2.03	2.04	0.24	1.90		2.34
Nonmetals							
Silica, Si	7.0	3.0	5.0	5.0	6.0		4.7
Sulfate, SO_4	8.4	11	9.5	11	7.4		9.0
Chloride, Cl	9.0	9.5	8.7	9.2	8.5		9.5
Fluoride, F	0.26	0.02	0.48	0.60	0.12		0.52
Bicarbonate, HCO_3	34	36	17	30	38		15
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0		0.0
Nitrate, N	0.26	0.51	0.06	0.10	0.17		0.01
Phosphate, P	0.72	0.62	0.70	0.80	0.55		0.74
Hydrogen Sulfide, S	0.16	0.42	0.50	0.36	0.70		0.43
Alkalinity Total, $CaCO_3$	28.1	8.3	13.7	24	31		12
Hardness Total, $CaCO_3$	40	28	33	49	50		36
Hardness Noncarbonate, HCO_3	14	19	19	24	19		24
Hardness Calcium, $CaCO_3$	24	17	19	30	28		20
Hardness Magnesium, $CaCO_3$	14	7	9.9	18	19		11

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-17-78	5-19-78	6-23-78	7-28-78
Physical Examination							
Temperature °C	24.0	23.5	22.3	23.0	23	23.1	23.8
pH	5.42	6.30	5.70	5.65	5.60	5.12	5.70
Conductivity	78	117	80	81	75	73	97
Residue Filtrable, TDS dried at 180°C	45	93	53	55	52	49	63
Residue Nonfiltrable, TSS dried at 103-105°C	6.5	38	5.0	2.0	4.5	5.5	11
Color, PCU	<1.0	25	10	20	25	15	10
Turbidity, NTU	9.5	4.5	1.2	1.4	5.1	4.4	7.5
Metals							
Calcium, Ca	7.0	12	8.3	8.0	8.0	7.6	9.1
Magnesium, Mg	2.2	4.1	2.6	2.5	2.3	1.6	2.3
Sodium, Na	4.3	21	4.7	4.5	4.6	4.4	4.8
Potassium, K	0.58	0.80	0.64	0.54	0.79	0.35	1.19
Iron, Fe	2.79	1.83	2.05	2.17	2.57	2.24	2.68
Nonmetals							
Silica, Si	4.0	5.1	4.8	4.3	3.8	3.1	3.6
Sulfate, SO_4	8.5	10	10	12	10	13	17
Chloride, Cl	9.9	12	11	12	12	14	14
Fluoride, F	0.47	0.50	0.50	0.52	0.50	0.35	0.39
Bicarbonate, HCO_3	15	34	21	16	17	4.5	13
Carbonate, CO_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitrate, N	0.03	0.03	0.02	0.19	0.11	0.23	0.04
Phosphate, P	0.70	0.63	0.40	0.30	0.28	0.06	0.43
Hydrogen Sulfide, S	0.11	0.16	0.10	0.12	0.27	0.15	0.11
Alkalinity Total, $CaCO_3$	12	28	17	13	14	3.7	10
Hardness Total, $CaCO_3$	34	50	35	34	34	30	37
Hardness Noncarbonate, HCO_3	22	22	18	21	20	26	27
Hardness Calcium, $CaCO_3$	20	30	21	20	20	19	23
Hardness Magnesium, $CaCO_3$	9.1	17	11	10	9.5	6.6	9.5

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table B-11. ANALYSES OF GROUNDWATER FROM THE ARTESIAN AND FLORIDAN AQUIFERS.

Parameters[1]	Secondary Artesian Aquifer (FIS-1)		Floridan Aquifer (FIF-1)			
Sampling Date:	7/12/77	7/15/77	10/4/77	10/14/77	10/21/77	10/24/77
Temperature (°C)	26.0	25.5	30.2	29.2	-	29.5
pH (std. units)	7.62	7.5	7.2	7.3	-	7.5
Conductivity (μmhos/cm)	465	460	570	580	580	590
Total Dissolved Solids	307	319	371	366	371	370
Total Suspended Solids	87	5.0	0.0	0.0	0.0	0.0
Total Alkalinity as $CaCO_3$	174	152	136	147	148	147
Total Hardness as $CaCO_3$	206	200	246	252	249	247
Calcium	41	39	51	58	57	56
Magnesium	25	25	29	26	26	26
Sodium	27	25.7	9.2	9.0	9.2	9.2
Potassium	3.0	3.0	0.19	1.99	2.02	2.03
Iron	0.26	0.07	0.03	0.02	0.01	<0.01
Silica	23	18	10	9.0	10	10
Sulfate	45	45	100	100	100	100
Chloride	21.3	20.7	11	11	11	12
Fluoride	3.0	2.8	0.25	0.25	0.25	0.25
Bicarbonate	212	185	165	179	180	179
Nitrate	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphate	0.136	0.03	<0.01	<0.01	<0.01	<0.02
Hydrogen Sulfide	1.20	1.64	2.9	3.2	3.1	3.1
Radium-226 (pCi/ℓ)[2]	16.0(7/77)	15.2(2/78)	6.7(10/77)	2.5(10/77)	1.9(2/78)	13.9(7/78)
Gross Alpha (pCi/ℓ)[2]						
Dissolved	11.1(7/77)	12.1(2/78)	<3.7(7/77)	<2.6(10/77)	<1.0(2/78)	9.3(7/78)
Suspended	6.2(7/77)	<3.5(2/78)	<3.1(7/77)	<1.0(10/77)	<2.6(2/78)	<6.0(7/78)

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[1] All units in mg/ℓ unless otherwise noted.

[2] Radiologic samples were taken on dates shown in parentheses.

Table B-12. RESULTS OF SPECIAL TRACE ELEMENTS STUDY CONDUCTED FOR FARMLAND INDUSTRIES, INC. BY P.E. LA MOREAUX & ASSOCIATES, INC.; OCTOBER 1979.

Parameters	FIF-1*	FIS-3	PT-1	PT-2
Temperature, °C	24.8	24.0	24.0	26.0
pH (units)	7.10	6.02	4.90	5.25
Conductivity (μmhos/cm)	415	470	88	102
Color (PCU)	<5	<5	<5	<5
Turbidity (NTU)	<0.1	<0.1	<0.1	<0.1
Calcium, Ca	37	35	8.2	8.2
Magnesium, Mg	21.5	25	2.7	2.8
Sodium, Na	9.5	31.5	5.2	4.8
Potassium, K	2.0	3.1	0.4	0.6
Alkalinity, $CaCO_3$	138	197	19.3	18.8
Carbonate, CO_3	ND**	ND	ND	ND
Chloride, Cl	16.5	37.0	16.3	16.0
Fluoride, F	0.24	1.39	0.25	0.30
Sulfate, SO_4	90.0	26.0	3.5	11.5
Total Dissolved Solids	302	316	53	63
Total Suspended Solids	0.0	0.0	0.0	0.0
Silica Total, Si	4.9	24.3	2.7	4.7
Hydrogen Sulfide	0.24	4.0	1.52	0.32
Bicarbonate, HCO_3	168	240	23.5	22.9
Ammonia, N	0.21	0.3	0.34	0.11
Nitrite, N	16.2	2.2	0.8	2.0
Nitrate, N	<0.001	<0.001	0.015	0.040
Organic Nitrogen, N	<0.01	<0.01	<0.01	<0.01
Total Phosphates, P	0.006	0.03	1.16	0.70
Ortho Phosphates, P	0.006	0.03	1.140	0.70
Total Hardness, $CaCO_3$	181	190	31.2	32.1
Calcium Hardness, $CaCO_3$	92.4	87.4	20.5	20.5
Magnesium Hardness, $CaCO_3$	88.4	102.9	10.7	11.5
TRACE METALS: μg/l (ppb)				
Arsenic, As	<1	<1	<1	<1
Barium, Ba	21	17	8	7
Cadmium, Cd	<1	<1	<1	1.6
Chromium, Cr	<1	<1	<1	<1
Copper, Cu	2.7	0.8	1.3	2.2
Iron, Fe	1100	90	730	1640
Lead, Pb	<1	<1	<1	<1
Manganese, Mn	107	9	4	12
Mercury, Hg	ND	ND	ND	ND
Nickel, Ni	<1	<1	<1	<1
Selenium, Se	<1	<1	<1	<1
Silver, Ag	<1	<1	<1	<1
Zinc, Zn	80	7	5	17
Cyanide, Cn	36	95	<0.02	<0.02

*See Figure 6-28 for sample locations. All results in mg/l unless noted.

**ND = None detected.

Source: P.E. LaMoreaux & Associates, Inc. (1980).

Table B-13. RESULTS OF LABORATORY ANALYSES OF GROUNDWATER FROM VARIOUS LOCATIONS[1] ON THE PROPOSED FARMLAND INDUSTRIES, INC. MINE PROPERTY , HARDEE COUNTY, FLORIDA; OCTOBER 1979 AND MARCH 1980[2] (Continues, Page 1 of 2).

Parameter	LOCATION								
	FIF-1		FIS-3		PT-1		PT-2		
	Oct.[1] '79	March[1] '80	Oct. '79	March '80	Oct. '79	March '80	Oct. '79	March '80	
Bacteriological and Miscellaneous									
Oxidation Reduction Potential, mv	140	145	110	110	100	110	140	130	
pH, pH Units	8.30	8.55	7.5	7.6	5.6	5.8	6.0	6.15	
Specific Conductance, umhos/cm	443	304	479	486	102	87	109	82	
Total Dissolved Solids, mg/l[3]	313	393	317	308	298	79	75	135	
Total Suspended Solids, mg/l	ND[4]	ND	ND	ND	ND	ND	ND	ND	
Turbidity, NTU	2.1	2.5	0.3	3.1	3.8	.45	8.5	17.8	
Color, units	6	4	0	ND	0	5	0	3	
Fecal Streptococcal Bacteria, colonies/100 ml	ND	ND	ND	ND	ND	ND	ND	ND	
Fecal Coliform Bacteria, colonies/100 ml	64	720	32	640	129	2	100	4	
Dissolved Oxygen, mg/l	8.5	9.7	3.0	4.7	4.9	5.5	8.35	6.7	
BOD_5, mg/l	ND	13	ND	ND	ND	ND	ND	ND	
Nutrients									
Ammonia Nitrogen, mg/l as N	ND	ND	ND	ND	ND	0.33	ND	0.33	
Total Kjeldahl Nitrogen, mg/l as N	ND	ND	0.60	ND	1.0	ND	1.0	ND	
Organic Nitrogen, mg/l as N	ND	ND	0.60	ND	1.0	ND	1.0	ND	
Orthophosphate, as PO_4, mg/l	ND	ND	ND	0.2	2.82	3.30	1.28	1.05	
Total Phosphorus, as PO_4, mg/l	ND	ND	ND	ND	2.82	3.30	1.28	1.4	
Nitrate/Nitrogen, mg/l as N	0.46	ND	0.42	ND	0.50	ND	0.45	1.2	
Nitrite/Nitrogen, mg/l as N	ND	ND	ND	ND	ND	ND	ND	ND	
Cations and Minerals									
Calcium, mg/l	48	50	32	36	9	9	10	10	10
Calcium Hardness, mg/l as $CaCO_3$	120	125	80	90	22	22	25	25	25
Magnesium, mg/l	20	22.6	23.7	25.0	2.1	2.5	3.2	3.0	3.1
Magnesium Hardness, mg/l as $CaCO_3$	82	93	97.5	103	8.6	10	13	12	13
Total Hardness, by EDTA Titration, mg/l as $CaCO_3$	210	244	192	192	32	36	40	68	36
Sodium, mg/l	10.1	9.8	25	30	6.7	6.2	6.1	6.0	9.2
Potassium, mg/l	2.00	2.0	2.86	3.5	0.55	0.37	0.69	0.50	0.87
Silica, mg/l as SiO_2 by AA	10	19	55	60	5.0	4.0	11	11	24
Iron, Ferrous, mg/l	ND	0.05	ND	ND	ND	0.75	0.19	1.5	0.22
Iron, Total, mg/l	1.11	0.41	0.35	0.14	0.79	0.80	1.72	1.5	0.57
Anions									
Alkalinity, Partial, mg/l as $CaCO_3$	4	2	0	0	0	0	0	0	0
Alkalinity, Total, mg/l as $CaCO_3$	125	150	187	205	18	25	23	20	33
Bicarbonate, mg/l as HCO_3	142	183	228	250	22	30	28	24	40
Carbonate, mg/l as CO_3	5	3	0	0	0	0	0	0	0
Chloride, mg/l	14	19	31	31	12	13	12	15	7
Cyanide, mg/l	ND	.147	ND	1.0	ND	1.07	ND	ND	ND
Fluoride, mg/l	0.39	ND	3.80	0.39	0.40	ND	0.62	0.12	1.00
Sulfate, mg/l	88	106	22	17	ND	4	8	11	ND
Sulfide, mg/l[5]	0.21	0.45	3.07	4.80	0.33	0.27	0.05	0.03	0.05
Temp. (°C)									
Heavy Metals									
Arsenic, mg/l	ND	ND	.002	ND	0.001	ND	0.002	ND	ND
Barium, mg/l	0.055	0.07	ND	0.01	ND	0.01	ND	ND	ND
Beryllium, mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium, mg/l	ND	ND	ND	ND	ND	ND	0.0006	ND	0.0009
Chromium, Hexavalent, mg/l	ND	.004	ND	ND	ND	ND	ND	ND	ND
Copper, mg/l	ND	0.0035	ND	0.0032	0.0012	0.0035	ND	0.0036	ND
Lead, mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese, mg/l	0.10	0.08	0.004	0.002	0.007	0.006	0.013	0.014	0.007
Mercury, mg/l	ND	ND	0.0003	0.0001	ND	ND	0.0003	0.0002	0.0003
Nickel, mg/l	0.0026	ND	ND	ND	0.0028	ND	0.0028	ND	ND
Selenium, mg/l	ND	ND	ND	ND	0.003	ND	0.001	ND	0.003
Silver, mg/l	ND	0.00008	ND	ND	ND	ND	ND	ND	ND
Zinc, mg/l	ND	ND	ND	ND	ND	ND	ND	0.05	ND

Table B-13 RESULTS OF LABORATORY ANALYSES OF GROUNDWATER FROM VARIOUS LOCATIONS[1] ON THE PROPOSED FARMLAND INDUSTRIES, INC. MINE PROPERTY, HARDEE COUNTY, FLORIDA; OCTOBER 1979 AND MARCH 1980[2], (Concluded, Page 2 of 2).

	LOCATION							
	FIF-1		FIS-3		PT-1		PT-2	
Parameter	Oct.[1] '79	March[1] '80	Oct. '79	March '80	Oct. '79	March '80	Oct. '79	March '80
Organics								
Total Organic Carbon, mg/l	7	17	8	20	9	11	3	21
Dissolved Organic Carbon, mg/l	2	11	ND	21	8	11	3	21
Phenolic Compounds, mg/l	0.010	ND	ND	ND	ND	ND	ND	ND
Surfactants, mg/l as MBAS	ND	ND	0.15	ND	0.15	ND	ND	ND
Oil and Grease, mg/l	ND	ND	1	ND	1	ND	1	ND
Organochlorine Pesticides								
Lindane, ug/l	ND	-[6]	ND	-	ND	-	ND	-
Heptachlor, ug/l	ND	-	ND	-	ND	-	ND	-
Aldrin, ug/l	ND	-	ND	-	ND	-	ND	-
Dieldrin, ug/l	ND	-	ND	-	ND	-	ND	-
Endrin, ug/l	ND	-	ND	-	ND	-	ND	-
Endosulfan, ug/l	ND	-	ND	-	ND	-	ND	-
p, p-DDT, ug/l	ND	-	ND	-	ND	-	ND	-
Methoxychlor, ug/l	ND	-	ND	-	ND	-	ND	-
Toxaphene, ug/l	ND	-	ND	-	ND	-	ND	-
Chlordane, ug/l	ND	-	ND	-	ND	-	ND	-
PCB's, ug/l	ND	-	ND	-	ND	-	ND	-
Mirex, ug/l	ND	-	ND	-	ND	-	ND	-
Phenoxy Acid Herbicides								
2, 4 - D, ug/l	ND	-	ND	-	ND	-	ND	-
2, 4, 5 - TP (Silvex), ug/l	ND	-	ND	-	ND	-	ND	-
Organophosphorous Pesticides								
Demeton, ug/l	ND	-	ND	-	ND	-	ND	-
Malathion, ug/l	ND	-	ND	-	ND	-	ND	-
Parathion, ug/l	ND	-	ND	-	ND	-	ND	-
Guthion, ug/l	ND	-	ND	-	ND	-	ND	-
Gross Alpha, pCi/l		-		-		-		-
Thorium-240, pCi/l		-		-		-		-
Gross Beta, pCi/l		-		-		-		-
Total Uranium, ug/l		-		-		-		-
Radium-226, pCi/l		-		-		-		-

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[1] See Figure 6-2 8 for sample locations (FIF-1, FIS-3, PT-1 and PT-2).

[2] Analyses performed for Woodward-Clyde Consultants (WCC) by Wilson Laboratories, Salina, Kansas.

[3] Result may be artificially high due to finely divided particles not removed by 0.45 μ filter.

[4] ND = None Detected.

[5] Undissociated sulfide is approximately 80% of these levels according to the pH, conductivity, and temperature data using 14th Edition Std. Methods, pg. 507.

[6] No analysis made.

APPENDIX C

Table C-1. AVERAGE DAILY GAUGE HEIGHTS RECORDED AT STATION SW-2 ON THE FARMLAND INDUSTRIES, INC. PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978.

1977	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Month						
1		dry	1.55	1.65	1.78	1.68	1.34
2		dry	1.54	1.70	2.84	1.64	1.35
3		dry	1.51	2.75	2.77	1.70	1.40
4		dry	1.48	3.11	2.63	1.87	1.39
5		dry	1.43	3.85	2.45	1.76	1.38
6		dry	1.38	4.14	2.28	1.68	1.46
7		dry	1.35	4.09	2.18	1.63	1.50
8		dry	1.33	3.88	1.99	1.58	1.47
9		dry	1.29	3.61	1.89	1.55	1.49
10		dry	1.28	3.35	1.83	1.53	1.62
11		dry	1.27	3.10	1.78	1.50	1.59
12		dry	1.28	2.83	1.69	1.46	1.58
13		dry	1.40	2.60	1.64	1.43	1.58
14		dry	1.51	2.41	1.58	1.41	1.58
15		dry	1.68	2.25	1.53	1.38	1.60
16		dry	1.80	2.10	1.49	1.36	1.82
17		dry	1.89	2.01	1.45	1.34	2.03
18		dry	1.82	1.93	1.41	1.33	2.49
19		dry	1.75	1.88	1.38	1.31	2.87
20		dry	1.66	1.80	1.35	1.28	2.92
21		dry	1.58	1.75	1.33	1.26	2.86
22		*	1.54	1.87	1.29	1.23	2.75
23		-	1.53	1.85	1.28	1.28	2.60
24		-	1.57	1.84	1.43	1.47	2.48
25		-	1.50	1.84	1.69	1.44	2.48
26		-	1.46	1.83	1.58	1.41	2.36
27	dry	1.31	1.50	1.83	1.54	1.36	2.28
28	dry	1.35	1.57	1.92	1.60	1.33	2.20
29	dry	1.21	1.55	2.14	1.67	1.34	2.14
30	dry	1.42	1.77	2.55	1.70	1.35	2.10
31		1.55	1.83		1.70		2.07

* Rained and float line came off recorder; no data until 7-27-77.

1978	Jan.	Feb.	March	April	May	June	July	Aug.
				Month				
1	2.03	2.14	2.33	1.33	0.24	0.13	2.25	3.55
2	1.98	2.07	2.21	1.30	0.21	0.16	2.15	3.50
3	1.95	2.03	2.35	1.27	0.19	0.20	2.04	3.77
4	1.89	1.99	2.61	1.25	0.18	0.22	2.01	4.13
5	1.86	1.93	2.62	1.23	0.18	0.23	2.24	4.34
6	1.83	1.87	2.78	1.21	0.18	0.24	3.01	4.31
7	1.80	1.83	2.79	1.18	0.18	0.25	3.43	4.15
8	1.76	1.81	2.70	1.16	0.18	0.25	3.90	3.95
9	1.77	1.84	2.50	1.14	0.18	0.25	4.48	3.70
10	1.74	1.83	2.96	1.10	0.18	0.53	4.42	3.48
11	1.71	1.81	3.00	1.08	0.18	1.65	4.19	3.30
12	1.68	1.79	3.08	1.01	0.18	1.85	3.92	3.06
13	1,90	1.78	3.00	0.97	0.18	1.63	3.63	2.88
14	2.12	*NR	2.85	0.93	0.18	1.48	3.40	2.64
15	2.11	NR	2.69	0.87	0.16	1.44	3.42	2.50
16	2.25	NR	2.54	0.84	0.15	1.45	3.52	2.49
17	2.43	NR	2.37	0.77	0.13	1.46	3.65	2.30
18	2.62	NR	2.22	0.73	0.10	1.48	3.78	2.43
19	2.78	NR	2.10	0.73	0.05	1.50	3.91	2.23
20	3.32	NR	2.00	0.63	0.03	1.52	4.07	2.13
21	3.71	NR	1.92	0.56	0.03	1.50	4.05	2.03
22	3.85	NR	1.85	0.51	0.03	1.50	3.97	1.95
23	3.65	NR	1.77	0.45	0.03	1.66	3.86	
24	3.42	NR	1.71	0.40	0.03	1.78	3.73	
25	3.35	NR	1.66	0.33	0.03	2.07	3.60	
26	2.97	NR	1.61	0.27	0.03	2.69	3.35	
27	2.78	NR	1.56	**0.25	0.03	2.93	3.26	
28	2.61	NR	1.52	0.25	0.03	2.86	3.50	
29	2.45		1.47	0.25	0.03	2.66	3.53	
30	2.33		1.43	0.25	0.04	2.44	3.65	
31	2.23		1.36		0.09		3.65	

* Clock not operating 2-14-78 through 3-1-78.

** Readings below 0.25 indicate ponded (no flow) data.

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table C-2. AVERAGE DAILY GAUGE HEIGHTS RECORDED AT STATION SW-8 ON THE FARMLAND INDUSTRIES, INC. PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978.

			Month				
1977	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
1		NR	NR	2.09	2.73	1.41	1.09
2		NR	0.93	2.04	2.85	1.36	1.10
3		NR	1.15	3.89	2.80	1.45	1.13
4		NR	1.07	5.01	2.62	1.89	1.09
5		NR	0.94	5.39	2.41	1.78	1.08
6		NR	0.85	4.92	2.58	1.74	1.18
7		NR	0.78	4.60	2.48	1.68	1.22
8		NR	0.77	4.34	2.03	1.58	1.24
9		NR	NR	4.04	1.76	1.46	1.31
10		NR	NR	3.71	1.63	1.36	1.56
11		NR	0.57	3.40	1.75	1.25	1.53
12		NR	0.95	3.04	1.52	1.18	1.48
13		NR	0.90	2.72	1.37	1.12	1.45
14		NR	1.36	2.44	1.26	1.06	1.43
15		NR	2.00	2.18	1.18	1.02	1.42
16		0.82	2.68	1.99	1.45	0.98	1.63
17		0.81	2.59	1.90	1.77	0.95	1.92
18		NR	2.21	1.86	1.77	0.92	2.32
19		NR	1.82	2.06	1.76	0.89	2.67
20		NR	1.56	1.79	1.75	0.84	2.87
21		1.10	1.32	1.69	1.73	0.77	2.89
22		0.79	1.36	2.16	1.73	0.74	2.80
23		NR	1.56	1.92	1.74	0.84	2.60
24		1.44	1.73	1.80	2.13	1.30	2.43
25		0.85	1.60	1.81	2.44	1.23	2.31
26		0.88	1.51	1.77	1.85	1.15	2.33
27	0.38	0.67	1.53	1.78	1.57	1.09	2.19
28	*NR	NR	1.73	2.02	1.46	1.06	2.09
29	NR	NR	1.66	2.13	1.47	1.04	2.01
30	NR	NR	2.09	2.38	1.49	1.11	1.94
31		NR	2.48		1.46		1.88

				Month				
1978	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**
1	1.83	1.94	2.32	0.78	0.90	0.70	2.20	3.98
2	1.78	1.86	2.14	0.75	0.86	0.69	2.38	3.86
3	1.72	1.84	2.58	0.72	0.82	0.70	2.24	4.31
4	1.65	1.75	3.58	0.69	0.83	0.74	2.45	4.53
5	1.08	1.65	3.29	0.87	0.81	0.72	2.31	4.60
6	1.02	1.59	3.09	0.88	0.71	0.74	2.70	4.70
7	1.47	1.52	2.98	0.79	0.70	0.72	3.31	4.54
8	1.48	1.50	2.82	0.81	0.69	0.80	3.75	4.30
9	1.57	1.73	3.57	0.97	0.69	0.89	4.60	4.05
10	1.59	1.64	3.84	0.82	0.65	1.03	4.83	3.85
11	1.60	1.58	3.58	0.71	0.69	2.99	4.60	3.68
12	1.46	1.54	3.42	0.83	0.69	4.14	4.26	3.40
13	1.59	1.52	3.28	0.76	0.69	3.44	3.94	3.12
14	2.29	1.48	3.06	0.72	0.69	2.64	3.63	3.10
15	2.57	1.44	2.[illegible]0	0.69	0.68	2.02	3.44	3.23
16	2.36	1.60	2.57	0.68	0.68	1.67	3.56	2.57
17	2.75	2.03	2.32	0.68	0.68	1.45	3.72	2.54
18	2.72	3.03	2.12	0.68	0.81	1.31	3.88	3.40
19	2.69	4.06	1.95	0.69	0.87	1.39	4.00	2.68
20	3.80	4.23	1.83	0.73	0.82	1.81	4.21	2.28
21	3.95	4.42	1.77	0.92	0.70	1.65	4.29	2.07
22	4.04	4.24	1.58	0.90	0.70	1.83	4.23	1.91
23	3.97	3.92	1.45	0.90	0.70	2.39	4.17	1.84
24	3.73	3.60	1.35	0.83	0.70	2.71	4.10	
25	3.43	3.29	1.27	0.87	0.70	2.69	3.87	
26	3.13	3.00	1.18	0.81	0.70	2.71	3.60	
27	2.81	2.72	1.10	0.83	0.70	2.98	3.25	
28	2.59	2.50	1.02	0.83	0.70	2.96	4.16	
29	2.37		0.97	0.85	0.70	2.74	3.99	
30	2.19		0.91	0.84	0.70	2.42	3.97	
31	2.06		0.84		0.70		4.18	

* NR - No continuous record below 0.76 feet

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table C-3. AVERAGE DAILY GAUGE HEIGHTS RECORDED AT STATION SW-9 ON THE FARMLAND INDUSTRIES, INC. PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978.

	Month						
1977	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1		≤0.48	0.87	1.17	1.16	≤0.48	≤0.48
2		≤0.48	0.69	1.25	0.96	≤0.48	≤0.48
3		≤0.48	0.59	3.06	0.83	≤0.48	≤0.48
4		≤0.48	0.51	3.61	0.72	1.19	≤0.48
5		0.50	≤0.48	3.59	0.63	1.05	≤0.48
6		0.53	≤0.48	2.60	0.55	0.91	≤0.48
7		≤0.48	≤0.48	1.96	0.49	0.80	≤0.48
8		≤0.48	≤0.48	1.55	≤0.48	0.72	≤0.48
9		≤0.48	≤0.48	1.28	≤0.48	0.65	≤0.48
10		≤0.48	≤0.48	1.08	≤0.48	0.58	0.79
11		≤0.48	**NR	0.90	≤0.48	0.53	0.73
12		≤0.48	NR	0.76	≤0.48	≤0.48	0.66
13		≤0.48	NR	0.67	≤0.48	≤0.48	0.61
14		≤0.48	NR	0.57	≤0.48	≤0.48	0.58
15		≤0.48	NR	0.50	≤0.48	≤0.48	0.61
16		≤0.48	NR	≤0.48	≤0.48	≤0.48	0.98
17		≤0.48	1.10	≤0.48	≤0.48	≤0.48	1.13
18		0.50	0.92	≤0.48	≤0.48	≤0.48	1.13
19		0.60	0.77	≤0.48	≤0.48	≤0.48	1.07
20		0.71	0.66	≤0.48	≤0.48	≤0.48	1.00
21		1.00	0.59	≤0.48	≤0.48	≤0.48	0.93
22		1.32	0.58	0.50	≤0.48	≤0.48	0.92
23		1.14	0.64	0.51	≤0.48	≤0.48	0.87
24		1.30	0.93	0.50	≤0.48	≤0.48	0.83
25		1.17	1.59	≤0.48	1.15	≤0.48	0.81
26		0.95	1.30	0.90	1.08	≤0.48	0.85
27	*≤0.48	0.78	1.22	1.51	0.96	≤0.48	0.81
28	≤0.48	0.66	1.16	1.84	0.82	≤0.48	0.76
29	≤0.48	0.75	1.10	1.75	0.70	≤0.48	0.72
30	≤0.48	2.16	1.24	1.43	0.60	≤0.48	0.68
31		1.23	1.31		0.53		0.67

	Month							
1978	Jan.	Feb.	March	April	May	June	July	Aug.
1	0.65	0.57	0.62	≤0.48	≤0.48	≤0.48	0.64	1.18
2	0.63	0.56	0.59	≤0.48	≤0.48	≤0.48	1.26	1.30
3	0.61	0.60	0.91	≤0.48	≤0.48	≤0.48	1.32	1.76
4	0.58	0.57	1.27	≤0.48	≤0.48	≤0.48	1.11	1.70
5	0.55	0.53	1.02	≤0.48	≤0.48	≤0.48	0.98	1.52
6	0.53	0.50	0.90	≤0.48	0.54	≤0.48	0.91	1.33
7	0.50	≤0.48	0.83	≤0.48	0.49	≤0.48	1.31	1.16
8	0.49	≤0.48	0.76	≤0.48	≤0.48	≤0.48	3.82	1.03
9	0.53	0.60	1.36	≤0.48	≤0.48	≤0.48	2.55	0.96
10	0.53	0.62	1.52	≤0.48	≤0.48	0.53	1.93	1.00
11	0.48	0.58	1.15	≤0.48	≤0.48	0.94	1.56	0.96
12	≤0.48	0.54	0.98	≤0.48	≤0.48	1.37	1.31	0.93
13	≤0.48	0.50	0.87	≤0.48	≤0.48	0.98	1.15	0.89
14	1.39	0.48	0.78	≤0.48	≤0.48	0.71	1.04	0.88
15	1.07	≤0.48	0.73	≤0.48	≤0.48	0.52	0.98	0.83
16	0.93	0.57	0.67	≤0.48	≤0.48	≤0.48	0.96	0.75
17	1.01	0.81	0.60	≤0.48	≤0.48	≤0.48	0.98	0.70
18	1.29	1.39	0.55	≤0.48	≤0.48	≤0.48	1.05	0.65
19	1.49	2.25	0.53	≤0.48	≤0.48	≤0.48	1.08	0.60
20	2.19	1.86	0.49	≤0.48	≤0.48	≤0.48	1.28	0.55
21	1.61	1.64	0.48	≤0.48	≤0.48	≤0.48	1.45	0.50
22	1.35	1.35	≤0.48	≤0.48	≤0.48	≤0.48	1.38	0.46
23	1.16	1.11	≤0.48	≤0.48	≤0.48	0.71	1.34	
24	1.03	0.97	≤0.48	≤0.48	≤0.48	0.91	1.23	
25	0.93	0.86	≤0.48	≤0.48	≤0.48	0.43	1.13	
26	0.83	0.79	≤0.48	≤0.48	≤0.48	0.74	1.04	
27	0.81	0.73	≤0.48	≤0.48	≤0.48	0.64	1.57	
28	0.75	0.69	≤0.48	≤0.48	≤0.48	0.55	1.55	
29	0.68		≤0.48	≤0.48	≤0.48	≤0.48	1.38	
30	0.65		≤0.48	≤0.48	≤0.48	≤0.48	1.23	
31	0.62		≤0.48		≤0.48		1.21	

* No record. Stilling well is constructed such that recorder will not record water level below 0.48'; these water levels are 0.48' or less (≤0.48').

** No record (recorder changed from Type F to A-71).

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table C-4. AVERAGE DAILY GAUGE HEIGHTS RECORDED AT STATION SW-11 ON THE FARMLAND INDUSTRIES, INC. PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978.

	Month						
1977	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.49	1.85	2.32	1.43	0.89	0.95
2		2.93	1.36	2.68	1.27	0.87	0.96
3		2.75	1.14	5.29	1.14	1.08	1.10
4		2.48	1.07	5.88	1.04	2.92	0.91
5		2.36	0.94	5.94	0.92	2.22	0.86
6		3.69	0.85	5.38	0.84	1.49	1.43
7		1.85	0.85	4.73	0.81	1.26	1.25
8		1.31	0.84	4.04	0.77	1.14	0.97
9		1.06	0.84	3.51	0.75	1.03	1.22
10		0.91	0.86	3.08	0.83	0.95	2.06
11		0.75	0.92	2.75	1.05	0.88	1.30
12		0.65	0.86	2.45	0.93	0.81	1.08
13		0.61	1.62	2.18	0.82	0.77	1.00
14		0.59	2.94	1.91	0.74	0.76	1.01
15		1.03	2.98	1.64	0.70	0.73	1.09
16		2.89	1.68	1.41	0.68	0.72	3.72
17		4.26	2,13	1.32	0.65	0.72	3.94
18		3.88	1.56	1.21	0.63	0.71	3.29
19		4.05	1.21	1.66	0.62	0.71	2.68
20		4.92	1.05	1.30	0.61	0.68	2.27
21		5.06	0.90	1.15	0.60	0.67	2.01
22		*NR	1.00	3.78	0.61	0.69	2.13
23		NR	1.80	2.42	0.65	0.83	1.78
24		4.08	4.61	1.77	1.61	2.17	1.58
25		3.92	5.49	1.78	3.62	1.40	1.48
26		2.78	4.57	4.31	1.81	1.14	2.33
27	0.19	1.84	3.40	3.27	1.43	0.93	1.90
28	0.14	1.50	3.02	3.37	1.23	0.86	1.60
29	0.12	1.45	2.49	2.23	1.09	0.83	1.43
30	0.46	2.14	2.70	1.72	0.99	0.95	1.33
31		2.22	2.54		0.94		1.32

* No Record - Recorder Malfunction

	Month							
1978	Jan.	Feb.	March	April	May	June	July	Aug.
1	1.31	1.34	1.52	0.63	0.34	0.37	2.43	3.55
2	1.28	1.21	1.41	0.62	0.35	0.38	4.23	3.23
3	1.22	1.53	2.54	0.61	0.34	0.40	3.58	4.69
4	1.13	1.45	4.33	0.58	1.38	0.57	3.37	5.16
5	1.07	1.31	3.11	0.56	1.25	0.46	3.45	4.73
6	1.03	1.21	2.47	0.57	2.43	0.57	2.92	4.35
7	1.00	1.18	2.06	0.54	3.10	0.49	3.27	3.82
8	1.00	1.10	1.78	0.53	1.38	1.06	5.07	3.42
9	1.38	1.95	3.98	0.54	1.04	1.95	4.22	3.11
10	1.19	1.73	4.27	0.55	0.79	1.29	4.60	3.19
11	1.05	1.42	3.14	0.50	0.67	3.53	4.07	3.36
12	0.98	1.28	2.56	0.49	0.58	4.17	3.52	2.35
13	2.70	1.33	2.17	0.51	0.55	1.65	5.02	2.52
14	3.66	1.10	1.89	0.53	0.50	1.12	4.89	2.64
15	2.44	1.03	1.67	0.56	0.46	0.88	4.19	2.52
16	1.09	1.42	1.53	0.46	0.44	0.78	3.91	1.87
17	2.21	3.16	1.34	0.43	0.40	0.68	3.59	1.64
18	3.23	4.29	1.18	0.43	0.45	*NR	4.23	1.52
19	2.94	5.49	1.10	0.42	0.77	NR	4.38	1.50
20	5.31	4.94	1.04	0.42	2.09	NR	4.75	1.62
21	4.41	4.63	1.00	0.39	0.45	0.92	5.03	1.48
22	3.62	4.08	0.96	0.38	0.67	1.21	4.13	1.33
23	3.06	3.49	0.91	0.37	0.58	2.54	4.75	
24	2.59	3.00	0.87	0.38	0.52	2.93	4.55	
25	2.31	2.57	0.82	0.38	0.49	3.47	4.15	
26	2.03	2.16	0.78	0.37	0.45	2.26	2.53	
27	1.89	1.89	0.75	0.37	0.44	2.22	3.52	
28	1.59	1.68	0.71	0.36	0.45	2.08	4.87	
29	1.40		0.70	0.34	0.47	1.61	4.15	
30	1.35		0.67	0.33	0.46	1.96	3.62	
31	1.28		0.64		0.39		3.57	

* NR - No Record

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table C-5. AVERAGE DAILY GAUGE HEIGHTS RECORDED AT STATION SW-13 ON THE FARMLAND INDUSTRIES, INC. PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978.

	Month						
1977	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.52	0.95	1.15	0.77	0.18	0.14
2		0.36	0.74	1.02	0.60	0.16	0.14
3		0.26	0.64	1.39	0.48	0.19	0.20
4		0.29	0.57	1.73	0.39	0.66	0.16
5		0.35	0.48	2.07	0.33	0.69	0.10
6		0.42	0.43	2.17	0.27	0.54	0.18
7		0.44	0.40	1.69	0.22	0.41	0.21
8		0.37	0.37	1.25	0.18	0.33	0.21
9		*NR	0.35	0.98	0.15	0.26	0.17
10		NR	0.32	0.79	0.12	0.21	0.42
11		NR	0.33	0.64	0.20	0.17	0.32
12		NR	0.33	0.52	0.20	0.13	0.25
13		NR	0.46	0.44	0.14	0.10	0.20
14		NR	*NR	0.38	0.11	0.09	0.19
15		0.35	2.42	0.29	0.09	0.07	0.19
16		0.37	1.48	0.25	0.07	0.06	0.46
17		0.42	1.23	0.26	0.05	0.05	0.68
18		0.45	0.95	0.28	0.04	0.04	0.69
19		0.48	0.78	0.32	0.03	0.03	0.62
20		*NR	0.65	0.25	0.02	0.01	0.53
21		NR	0.58	0.24	0.01	0.00	0.46
22		NR	0.57	0.35	0.00	0.01	0.49
23		NR	0.76	0.34	0.00	0.06	0.42
24		NR	1.00	0.32	0.09	0.30	0.35
25		NR	1.42	0.30	0.68	0.24	0.31
26		NR	1.21	0.57	0.70	0.18	0.46
27	0.13	0.82	1.13	1.44	0.58	0.13	0.39
28	0.13	0.74	1.10	1.73	0.47	0.11	0.32
29	0.14	0.65	0.95	1.30	0.37	0.10	0.27
30	0.18	1.20	1.08	1.00	0.29	0.15	0.23
31		1.45	1.31		0.23		0.22

* NR - No record - Plugged intake to stilling well

	Month							
1978	Jan.	Feb.	March	April	May	June	July	Aug.
1	0.20	0.13	0.16	-0.18	-0.23	NR	0.15	0.72
2	0.18	0.11	0.12	-0.18	-0.23	NR	1.64	0.65
3	0.16	0.13	1.07	-0.19	-0.23	NR	1.15	1.02
4	0.14	0.12	1.28	-0.19	-0.21	NR	0.74	1.61
5	0.12	0.10	0.67	-0.18	-0.23	NR	0.50	1.25
6	0.10	0.07	0.46	-0.18	-0.20	NR	0.45	1.03
7	0.09	0.05	0.35	-0.19	-0.07	NR	0.46	0.77
8	0.09	0.04	0.26	-0.19	-0.17	NR	2.93	0.54
9	0.15	0.22	1.06	-0.19	-0.18	NR	2.26	0.41
10	0.11	0.20	1.32	-0.19	-0.18	NR	1.53	0.37
11	0.08	0.15	0.76	-0.20	-0.19	NR	1.08	0.34
12	0.07	0.12	0.52	-0.20	-0.19	NR	0.77	0.28
13	0.41	0.08	0.37	-0.20	-0.19	NR	0.54	0.23
14	1.17	0.04	0.28	-0.20	-0.20	NR	0.38	0.46
15	0.71	0.02	0.21	-0.20	-0.20	NR	0.33	0.61
16	0.53	0.11	0.15	-0.21	-0.20	NR	0.34	0.18
17	0.50	0.55	0.08	-0.21	-0.20	NR	0.37	0.07
18	0.91	1.61	0.03	-0.21	-0.17	NR	0.55	0.04
19	0.87	1.98	0.01	-0.21	+0.18	NR	0.68	-0.10
20	1.95	1.35	0.00	-0.21	-0.05	NR	0.75	≤0.10
21	1.20	1.15	-0.01	-0.22	-0.12	NR	0.86	≤0.10
22	0.92	0.87	-0.02	-0.23	-0.14	0.29	0.84	≤0.10
23	0.73	0.65	-0.04	-0.23	-0.14	0.78	0.75	≤0.10
24	0.58	0.49	-0.05	-0.24	-0.15	0.58	0.62	≤0.10
25	0.48	0.38	-0.07	-0.24	-0.15	0.44	0.42	
26	0.42	0.30	-0.09	-0.24	-0.15	0.30	0.30	
27	0.34	0.23	-0.11	-0.24	-0.15	0.19	0.61	
28	0.28	0.20	-0.13	-0.24	-0.16	0.12	1.58	
29	0.23		-0.15	-0.23	-0.16	0.04	1.16	
30	0.18		-0.16	-0.23	*NR	-0.02	1.06	
31	0.15		-0.17		NR		0.91	

* NR - No Record

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table C-6. DISCHARGE SUMMARIES FOR STREAMFLOW GAGING STATIONS ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 1 of 3).

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-1	6-14-77	0.0	0.0	---
	7-20-77	4.33	<0.01	Estimated
	8-16-77	4.73	0.09	Pygmy Meter
	9-14-77	5.13	0.0	---
	10-27-77	4.57	0.0	---
	11-21-77	4.36	0.0	---
	12-15-77	4.55	0.01	Estimated
	1-11-78	4.58	0.02	Estimated
	2-13-78	4.57	0.0	---
	3-24-78	4.47	0.015	Estimated
	4-18-78	0.0	0.0	---
	5-18-78	0.0	0.0	---
	6-21-78	4.46	<0.01	Estimated
	7-25-78	5.48	0.04	Estimated
	8-23-78	4.68	0.0	---
SW-2	6-14-77	0.0	0.0	---
	7-20-77	-0.16	0.0	---
	8-16-77	1.74	2.96	Pygmy Meter
	9-14-77	2.42	11.02	Pygmy Meter
	10-27-77	1.55	2.32	Pygmy Meter
	11-21-77	1.26	0.44	Pygmy Meter
	12-15-77	1.58	1.94	Pygmy Meter
	1-11-78	1.72	2.64	Pygmy Meter
	2-13-78	1.78	3.00	Pygmy Meter
	3-24-78	1.68	2.40	Pygmy Meter
	4-18-78	0.72	0.0	---
	5-18-78	0.0	0.0	---
	6-21-78	1.50	1.75	Pygmy Meter
	7-25-78	3.56	35.11	Pygmy Meter
	8-23-78	1.90	5.66	Pygmy Meter
SW-3	6-14-77	0.0	0.0	---
	7-20-77	1.04	0.0	---
	8-16-77	1.36	0.0	---
	9-14-77	2.08	0.0	---
	10-27-77	2.00	0.0	---
	11-21-77	1.84	0.0	---
	12-15-77	1.91	0.0	---
	1-10-78	1.94	<0.01	Estimated
	2-13-78	1.97	0.0	---
	3-24-78	1.98	0.41	Estimated
	4-18-78	1.47	0.0	---
	5-18-78	--	0.0	---
	6-21-78	1.90	0.14	Estimated
	7-25-78	2.10	0.72	Pygmy Meter
	8-23-78	2.00	0.10	Pygmy Meter
SW-4	6-15-77	dry	0.0	---
	7-20-77	0.53	1.17	Pygmy Meter
	8-17-77	0.97	6.05	Pygmy Meter
	9-14-77	0.62	2.17	Pygmy Meter
	10-26-77	0.90	6.40	Pygmy Meter
	11-21-77	0.16	0.17	Estimated
	12-13-77	0.33	0.89	Pygmy Meter
	1-10-78	0.23	0.58	Pygmy Meter
	2-13-78	0.23	0.61	Pygmy Meter
	3-23-78	0.08	0.28	Pygmy Meter
	4-18-78	dry	0.0	---
	5-18-78	dry	0.0	---
	6-22-78	0.10	0.26	Pygmy Meter
	7-26-78	0.85	4.74	Pygmy Meter
	8-23-78	0.12	0.25	Pygmy Meter
SW-5	6-14-77	dry	*NM	---
	7-20-77	4.16	NM	---
	8-16-77	5.56	NM	---
	9-15-77	3.96	NM	---
	10-27-77	4.37	NM	---
	11-18-77	4.25	NM	---
	12-13-77	5.35	NM	---
	1-10-78	5.38	NM	---
	2-13-78	5.38	NM	---
	3-23-78	5.48	NM	---
	4-17-78	4.45	NM	---
	5-19-78	4.01	NM	---
	6-21-78	5.48	NM	---
	7-25-78	5.47	NM	---
	8-23-78	5.32	NM	---
SW-6	6-14-77	dry	0.0	---
	7-20-77	dry	0.0	---
	8-16-77	1.81	2.50	Pygmy Meter
	9-14-77	2.38	12.99	Pygmy Meter
	10-27-77	1.59	2.45	Pygmy Meter
	11-21-77	1.31	0.26	Pygmy Meter
	12-13-77	1.53	1.88	Pygmy Meter
	1-10-78	1.69	3.12	Pygmy Meter
	2-13-78	1.72	3.79	Pygmy Meter
	3-24-78	1.67	3.21	Pygmy Meter
	4-17-78	0.99	0.0	---
	5-18-78	dry	0.0	---
	6-21-78	1.54	2.31	Pygmy Meter
	7-25-78	3.36	47.15	Pygmy Meter
	8-23-78	1.89	7.47	Pygmy Meter

* NM - No discharge measurements taken

Table C-6. DISCHARGE SUMMARIES FOR STREAMFLOW GAGING STATIONS ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Continues, Page 2 of 3).

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-7	6-14-77	*NR	0.0	---
	7-20-77	1.35	<0.01	Estimated
	8-16-77	2.92	19.05	Pygmy Meter
	9-14-77	2.74	13.98	Pygmy Meter
	10-27-77	2.06	4.08	Pygmy Meter
	11-21-77	1.59	0.59	Pygmy Meter
	12-13-77	1.98	3.95	Pygmy Meter
	1-10-78	2.08	4.09	Pygmy Meter
	2-13-78	2.08	4.96	Pygmy Meter
	3-24-78	1.98	3.36	Pygmy Meter
	4-18-78	1.32	0.0	---
	5-18-78	0.96	0.0	---
	6-21-78	2.03	4.22	Pygmy Meter
	7-25-78	3.93	46.15	Pygmy Meter
	8-23-78	2.30	6.12	Pygmy Meter

* No record

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-8	6-17-77	0.40	0.01	Estimated
	7-20-77	0.64	0.34	Pygmy Meter
	8-17-77	2.62	17.05	Pygmy Meter
	9-14-77	2.41	14.77	Pygmy Meter
	10-27-77	1.56	4.87	Pygmy Meter
	11-21-77	0.80	0.68	Pygmy Meter
	12-13-77	1.45	4.64	Pygmy Meter
	1-10-78	1.62	5.95	Pygmy Meter
	2-13-78	1.52	5.21	Pygmy Meter
	3-24-78	1.34	4.47	Pygmy Meter
	4-18-78	0.68	0.26	Pygmy Meter
	5-18-78	0.88	1.35	Pygmy Meter
	6-21-78	1.60	6.35	Pygmy Meter
	7-25-78	3.84	53.11	Pygmy Meter
	8-23-78	1.84	8.17	Pygmy Meter
SW-9	6-15-77	dry	0.0	---
	7-20-77	0.60	1.66	Pygmy Meter
	8-17-77	1.10	8.57	Pygmy Meter
	9-14-77	0.55	2.69	Pygmy Meter
	10-26-77	1.08	8.44	Pygmy Meter
	11-21-77	0.16	0.12	Pygmy Meter
	*12-9-77	0.42	1.02	Pygmy Meter
	12-13-77	0.60	1.52	Pygmy Meter
	1-10-78	0.54	1.01	Pygmy Meter
	2-13-78	0.50	0.81	Pygmy Meter
	3-24-78	0.35	0.35	Pygmy Meter
	4-18-78	dry	0.0	---
	5-18-78	dry	0.0	---
	6-22-78	0.32	0.50	Pygmy Meter
	7-26-78	0.97	5.85	Pygmy Meter
	8-23-78	0.42	0.35	Pygmy Meter

* Cleaned channel

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-10	6-14-77	dry	*NM	---
	7-20-77	3.75	NM	---
	8-16-77	5.20	NM	---
	9-15-77	3.96	NM	---
	10-27-77	4.60	NM	---
	11-18-77	3.66	NM	---
	12-13-77	3.95	NM	---
	1-10-78	3.88	NM	---
	2-13-78	4.12	NM	---
	3-24-78	3.80	NM	---
	4-17-78	dry	NM	---
	5-19-78	dry	NM	---
	6-22-78	3.99	NM	---
	7-25-78	4.40	NM	---
	8-23-78	3.84	NM	---

* NM - No discharge measurements taken

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-11	6-15-77	0.29	1.37	Pygmy Meter
	7-21-77	4.28	59.04	Pygmy Meter
	8-17-77	2.24	17.31	Pygmy Meter
	9-15-77	1.64	8.33	Pygmy Meter
	10-27-77	1.41	8.19	Pygmy Meter
	11-22-77	0.69	2.67	Pygmy Meter
	12-13-77	1.00	4.70	Pygmy Meter
	1-10-78	1.21	6.26	Pygmy Meter
	2-14-78	1.13	5.89	Pygmy Meter
	3-23-78	0.92	3.48	Pygmy Meter
	4-18-78	0.43	1.22	Pygmy Meter
	5-18-78	0.42	1.18	Pygmy Meter
	6-21-78	0.92	4.44	Pygmy Meter
	7-26-78	2.55	9.35	Pygmy Meter
	8-23-78	1.30	5.28	Pygmy Metor
SW-12	6-15-77	1.78	1.78	Estimated
	7-21-77	3.47	53.75	Pygmy Meter
	8-18-77	2.39	9.94	Pygmy Meter
	9-15-77	2.34	7.42	Estimated
	10-28-77	2.24	6.31	Estimated
	11-22-77	1.98	2.43	Estimated
	12-15-77	2.20	4.76	Estimated
	1-11-78	2.12	4.48	Estimated
	2-14-78	2.24	5.56	Estimated
	3-24-78	2.08	3.24	Estimated
	4-18-78	1.46	1.80	Estimated
	5-18-78	1.74	1.14	Estimated
	6-21-78	2.08	3.00	Estimated
	7-26-78	2.67	19.36	Pygmy Meter
	8-23-78	2.13	4.00	Estimated

Table C-6. DISCHARGE SUMMARIES FOR STREAMFLOW GAGING STATIONS ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - AUGUST 1978 (Concluded, Page 3 of 3).

Station No.	Date	Gage Height (feet)	Discharge Cfs	Method
SW-13	6-15-77	0.15	0.10	Pygmy Meter
	7-20-77	0.48	1.86	Pygmy Meter
	8-17-77	1.17	14.26	Pygmy Meter
	9-15-77	0.29	2.71	Pygmy Meter
	10-26-77	0.68	10.10	Pygmy Meter
	11-21-77	0.00	0.47	Pygmy Meter
	12-13-77	0.20	2.46	Pygmy Meter
	1-10-78	0.11	1.94	Pygmy Meter
	2-3-78	0.09	1.77	Pygmy Meter
	3-24-78	-0.07	0.70	Pygmy Meter
	4-18-78	-0.21	0.08	Pygmy Meter
	5-18-78	-0.20	0.07	Pygmy Meter
	6-22-78	0.31	4.45	Pygmy Meter
	7-25-78	0.40	8.27	Pygmy Meter
	8-24-78	-0.25	0.84	Pygmy Meter
SW-14	6-15-77	3.46	0.0	---
	7-20-77	6.49	1.43	Pygmy Meter
	8-16-77	7.34	16.55	Pygmy Meter
	9-15-77	6.76	2.44	Pygmy Meter
	10-26-77	7.07	10.24	Pygmy Meter
	11-21-77	6.32	0.45	Pygmy Meter
	12-13-77	6.63	2.25	Pygmy Meter
	1-10-77	6.56	1.74	Pygmy Meter
	2-13-78	6.55	1.59	Pygmy Meter
	3-24-78	6.52	0.92	Pygmy Meter
	4-18-78	6.31	0.02	Estimated
	5-18-78	5.60	0.0	---
	6-22-78	6.77	4.19	Pygmy Meter
	7-25-78	7.17	8.30	Pygmy Meter
	8-24-78	6.54	1.07	Pygmy Meter

APPENDIX D

Table D-1. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-1 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-15-77	10-27-77	11-18-77	12-15-77
I. Physical Examination							
Temperature °C	(DRY)	24.5	27.0	(DRY)	(DRY)	(DRY)	21.0
pH		6.65	6.20				6.75
Conductivity		229	98				120
Residue Nonfiltrable, TSS dried at 103-105°C		8.0	17				4.0
Color, PCU		300	375				250
Turbidity, NTU		2.3	2.6				1.2
II. Nonmentals							
Sulfate, SO_4		3.4	1.0				<1.0
Fluoride, F		0.12	0.12				0.20
Phosphorous:							
Total Phosphate, P		0.60	0.27				0.38
Ortho Phosphate, P		0.45	0.20				0.29
Alkalinity Total, $CaCO_3$		112	33				55

PARAMETERS	DATE COLLECTED						
	1-11-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature °C	12.2	(DRY)	23.4	(DRY)	(DRY)	24.0	22.5
pH	6.85		6.60			6.58	6.30
Conductivity	96		82			112	108
Residue Nonfiltrable, TSS dried at 103-105°C	76		20			8.5	5.0
Color, PCU	250		400			400	400
Turbidity, NTU	6.5		2.4			0.75	1.2
II. Nonmentals							
Sulfate, SO_4	1.2		<1			1.5	1.3
Fluoride, F	0.19		0.17			0.15	0.16
Phosphorous:							
Total Phosphate, P	0.23		0.39			0.50	0.40
Ortho Phosphate, P	0.10		0.31			0.39	0.33
Alkalinity Total, $CaCO_3$	52		25			47	35

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-2. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-2 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-15-77	10-27-77	11-21-77	12-15-77
I. Physical Examination							
Temperature°C	(DRY)	(DRY)	27.0	26.8	22.5	19.5	19.8
pH			6.00	5.75	5.75	5.60	6.6
Conductivity			128	116	92	90	119
Residue Nonfiltrable, TSS dried at 103-105°C			7.5	23.5	7.0	11	104
Color, PCU			800	580	326	500	400
Turbidity, NTU			1.6	0.42	0.35	0.70	5.0
II. Nonmetals							
Sulfate, SO_4			2.5	2.0	<1.0	1.0	1.0
Fluoride, F			0.23	0.20	0.11	0.28	0.28
Phosphorous:							
Total Phosphate, P			0.96	1.03	0.38	0.26	0.57
Ortho Phosphate, P			0.87	0.96	0.08	0.16	0.40
Alkalinity Total, $CaCO_3$			25	23	14	15	12

PARAMETERS	DATE COLLECTED						
	1-11-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature°C	10.0	12.6	20.2	(DRY)	(DRY)	23.9	28.0
pH	6.10	6.15	6.20			6.22	6.00
Conductivity	98	106	100			148	83
Residue Nonfiltrable, TSS dried at 103-105°C	8.0	10.5	6.0			14	5.0
Color, PCU	400	400	500			500	400
Turbidity, NTU	0.70	1.0	0.54			1.1	0.70
II. Nonmetals							
Sulfate, SO_4	1.2	3.4	<1.0			<1.0	<1.0
Fluoride, F	0.26	0.27	0.30			0.26	0.18
Phosphorous:							
Total Phosphate, P	0.38	0.40	0.66			1.15	0.42
Ortho Phosphate, P	0.32	0.37	0.58			1.08	0.42
Alkalinity Total, $CaCO_3$	18	17	26			38	13

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-3. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-3 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-15-77	10-27-77	11-21-77	12-15-77
I. Physical Examination							
Temperature°C	(DRY)	(DRY)	(DRY)	(DRY)	(DRY)	(DRY)	(DRY)
pH							
Conductivity							
Residue Nonfiltrable, TSS dried at 103-105°C							
Color, PCU							
Turbidity, NTU							
II. Nonmetals							
Sulfate, SO_4							
Fluoride, F							
Phosphorous:							
Total Phosphate, P							
Ortho Phosphate, P							
Alkalinity Total, $CaCO_3$							

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature°C	13.0	(DRY)	21.6	(DRY)	(DRY)	23.9	26.0
pH	6.42		6.0			6.30	6.15
Conductivity	124	129	129			91	68
Residue Nonfiltrable, TSS dried at 103-105°C	<0.1	5.0				12	4.0
Color, PCU	400	900				508	400
Turbidity, NTU	0.80	0.84				1.2	1.2
II. Nonmetals							
Sulfate, SO_4	0.8	<1.0				1.2	1.3
Fluoride, F	0.24	0.32				0.21	0.16
Phosphorous:							
Total Phosphate, P	0.50	0.67				0.86	0.43
Ortho Phosphate, P	0.44	0.59				0.75	0.39
Alkalinity Total, $CaCO_3$	13	17				20	18

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-4. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-4 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13 77
I. Physical Examination							
Temperature°C	(DRY)	29.9	26.3	26.0	24.1	21.2	16.1
pH		6.25	5.40	5.30	6.18	5.80	5.75
Conductivity		156	88	77	86	100	92
Residue Nonfiltrable, TSS dried at 103-105°C		0.5	5.0	19.0	8.0	6.5	4.0
Color, PCU		525	450	400	250	300	200
Turbidity, NTU		1.4	1.4	0.74	0.7	0.75	0.45
II. Nonmetals							
Sulfate, SO_4		8.4	3.0	1.5	7.4	<1.0	2.0
Fluoride, F		0.16	0.19	0.20	0.08	0.32	0.28
Phosphorous:							
Total Phosphate, P		0.99	0.58	0.78	0.50	0.49	0.33
Ortho Phosphate, P		0.83	0.53	0.75	0.75	0.42	0.35
Alkalinity Total, $CaCO_3$		17	7.9	12	5.0	0.6	8.0

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-26-78
1. Physical Examination							
Temperature°·C	8.0	19.10	23.9	(Dry)	(Dry)	23.0	29.2
ph	6.6	6.15	6.40			5.65	5.75
Conductivity	93	80	93			95	68
Residue Nofiltrable, TSS dried at 103-105° C	1.5	7.0	3.0			9.5	6.0
Color, PCU	150	200	400			500	400
Turbidity, NTU	0.7	0.64	0.87			0.71	1.3
II. Nonmetals							
Sulfacte, SO_4	0.6	3.4	1.0			1.0	1.2
Fluoride, F	0.28	0.29	0.30			0.27	0.19
Phosphorous:							
Total Phosphate, P	0.47	0.45	0.79			0.38	0.61
Ortho Phosphate, P	0.40	0.41	0.69			0.33	0.47
Alkalinity Total, $CACO_3$	6.0	62	11			6.9	4.6

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-5. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-6 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13-77
I. Physical Examination							
Temperature°C	(DRY)	(DRY)	26.0	26.5	21.4	19.0	18.6
pH			6.80	6.30	6.55	6.60	6.40
Conductivity			132	112	115	112	87
Residue Nonfiltrable, TSS dried at 103-105°C			4.5	13.0	6.0	14	2.0
Color, PCU			600	600	300	500	400
Turbidity, NTU			1.9	0.50	1.4	1.5	1.1
II. Nonmetals							
Sulfate, SO_4			2.0	1.5	3.4	1.2	50
Fluoride, F			0.27	0.30	0.13	0.32	0.27
Phosphorous:							
Total Phosphate, P			0.95	1.10	0.50	0.39	0.33
Ortho Phosphate, P			0.86	1.01	0.28	0.33	0.27
Alkalinity Total, $CaCO_3$			32	33	30	28	19

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature°C	12.0	11.8	19.8	(DRY)	(DRY)	22.9	28.2
pH	7.00	6.90	6.75			6.55	6.20
Conductivity	105	110	112			164	70
Residue Nonfiltrable, TSS dried at 103-105°C	9.5	4.0	4.0			5.5	6.0
Color, PCU	300	250	500			600	400
Turbidity, NTU	1.1	1.0	0.40			0.75	0.90
II. Nonmetals							
Sulfate, SO_4	1.0	3.6	<1.0			4.0	1.0
Fluoride, F	0.27	0.27	0.31			0.30	0.18
Phosphorous:							
Total Phosphate, P	0.42	0.41	0.66			1.39	0.46
Ortho Phosphate, P	0.36	0.34	0.59			1.01	0.45
Alkalinity Total, $CaCO_3$	23	20	29			67	16

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-6. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-7 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13-77
I. Physical Examination							
Temperature°C	(DRY)	23.7	26.2	26.6	22.0	19.1	17.3
pH		6.63	6.50	6.45	7.20	6.60	6.60
Conductivity		186	106	116	249	115	101
Residue Nonfiltrable, TSS dried at 103-105°C		0.5	4.0	17	14	10	3.5
Color, PCU		135	550	600	250	400	400
Turbidity, NTU		1.0	2.1	1.8	0.09	1.2	0.85
II. Nonmetals							
Sulfate, SO_4		14	1.5	1.5	32	1.0	2.0
Fluoride, F		0.27	0.31	0.30	0.17	0.36	0.32
Phosphorous:							
Total Phosphate, P		1.78	1.03	1.13	0.45	0.45	0.56
Ortho Phosphate, P		1.58	0.95	1.03	0.30	0.40	0.51
Alkalinity Total, $CaCO_3$		48	25	23	98	36	21

PARAMETERS	DATE COLLECTED						
	1-20-78	2-13-78	3-23-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature°C	10.5	12.0	20.1	(DRY)	(DRY)	23.0	29.0
pH	7.02	6.95	6.80			6.52	6.55
Conductivity	105	108	118			157	70
Residue Nonfiltrable, TSS dried at 103-105°C	2.0	3.0	1.0			3.0	4.0
Color, PCU	320	300	500			500	400
Turbidity, NTU	1.0	0.79	0.75			0.58	1.2
II. Nonmetals							
Sulfate, SO_4	1.2	4.4	<1.0			6.8	1.2
Fluoride, F	0.29	0.29	0.31			0.33	0.19
Phosphorous:							
Total Phosphate, P	0.48	0.47	0.64			0.99	0.81
Ortho Phosphate, P	0.44	0.39	0.59			0.99	0.46
Alkalinity Total, $CaCO_3$	25	28	34			41	17

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-7. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-8 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13 77
I. Physical Examination							
Temperature°C	24.5	23.8	25.1	27.0	22.2	18.9	16.9
pH	6.80	6.90	6.35	6.60	7.22	6.80	6.95
Conductivity	240	433	117	129	264	175	128
Residue Nonfiltrable, TSS dried at 103-105°C	16.0	1.0	4.0	23	2.0	8.0	0.5
Color, PCU	40	125	680	610	200	300	400
Turbidity, NTU	4.2	1.6	1.7	1.1	0.7	1.2	1.1
II. Nonmetals							
Sulfate, SO_4	13.	84	2.0	1.5	33	8.0	8.0
Fluoride, F	0.33	0.28	0.31	0.30	0.18	0.48	0.32
Phosphorous:							
Total Phosphate, P	1.97	0.94	1.13	1.15	0.43	0.66	0.61
Ortho Phosphate, P	1.18	0.93	1.04	1.03	0.36	0.61	0.54
Alkalinity Total, $CaCO_3$	87	93	23	29	90	58	28

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-25-78
I. Physical Examination							
Temperature°C	10.5	12.5	19.5	20.0	22.0	23.4	27.5
pH	7.50	7.05	6.80	7.15	7.23	6.50	6.25
Conductivity	120	108	141	250	350	291	85
Residue Nonfiltrable, TSS dried at 103-105°C	5.0	16.8	1.0	5.0	3.0	6.0	7
Color, PCU	280	300	500	75	50	400	440
Turbidity, NTU	1.4	1.2	0.90	0.77	0.58	0.80	1.9
II. Nonmetals							
Sulfate, SO_4	21	7.4	5.4	47	75	41	1.4
Fluoride, F	0.32	0.31	0.38	1.1	0.74	0.36	0.18
Phosphorous:							
Total Phosphate, P	0.55	0.50	0.79	0.96	0.53	0.96	0.54
Ortho Phosphate, P	0.50	0.45	0.70	0.96	0.53	0.86	0.46
Alkalinity Total, $CaCO_3$	37	35	44	110	178	45	10

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-8. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-9 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13-77
I. Physical Examination							
Temperature°C	(DRY)	29.0	28	30.2	24.8	23.0	17.0
pH		6.45	5.90	5.80	6.50	6.40	6.70
Conductivity		179	108	88	122	125	129
Residue Nonfiltrable, TSS dried at 103-105°C		1.0	15.0	59	8.7	21	3.5
Color, PCU		375	440	375	175	250	200
Turbidity, NTU		1.6	2.6	0.81	1.4	3.0	0.55
II. Nonmetals							
Sulfate, SO_4		8.0	4.0	1.0	10	4.4	5.4
Fluoride, F		0.15	0.23	0.2	0.09	0.30	0.26
Phosphorous:							
Total Phosphate, P		1.17	0.66	0.93	0.56	0.61	0.36
Ortho Phosphate, P		1.00	0.58	0.75	0.36	0.43	0.31
Alkalinity Total, $CaCO_3$		31	15	12	10	14	13

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-18-78	5-18-78	6-22-78	7-26-78
I. Physical Examination							
Temperature°C	9.5	19.6	19.9	(DRY)	(DRY)	24.3	28.0
pH	6.56	6.62	6.60			6.30	6.20
Conductivity	104	106	125			128	85
Residue Nonfiltrable, TSS dried at 103-105°C	3.0	4.0	56			7.0	13
Color, PCU	250	230	400			300	360
Turbidity, NTU	0.8	0.85	0.62			1.6	1.9
II. Nonmetals							
Sulfate, SO_4	3.4	6.4	5.0			6.0	1.4
Fluoride, F	0.26	0.25	0.29			0.21	0.19
Phosphorous:							
Total Phosphate, P	0.40	0.49	0.86			0.40	0.54
Ortho Phosphate, P	0.34	0.31	0.75			0.35	0.46
Alkalinity Total, $CaCO_3$	15	20	28			29	23

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-9. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-11 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-19-77	10-27-77	11-22-77	12-14-77
I. Physical Examination							
Temperature°C	18.9	27.4	25.5	25.7	23.0	20.0	19.2
pH	6.50	6.65	6.62	6.40	6.80	7.10	6.95
Conductivity	345	105	215	159	268	258	233
Residue Nonfiltrable, TSS dried at 103-105°C	11	5.3	5.0	18	3.3	9.5	3.0
Color, PCU	50	400	420	490	100	50	100
Turbidity, NTU	0.4	1.7	2.9	0.81	0.65	0.8	1.3
II. Nonmetals							
Sulfate, SO_4	70	18	30	1.5	37	40	33
Fluoride, F	0.11	0.15	0.42	0.3	0.20	0.50	0.44
Phosphorous:							
Total Phosphate, P	0.96	2.92	0.91	0.93	0.61	0.67	0.58
Ortho Phosphate, P	0.85	0.95	0.81	0.78	0.56	0.50	0.53
Alkalinity Total, $CaCO_3$	34	25	32	26	21	40	43

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-18-78	5-18-78	6-21-78	7-26-78
I. Physical Examination							
Temperature°C	11.5	17.0	23.4	21.5	22.8	23.2	26.2
pH	7.35	6.70	7.70	6.75	6.87	7.25	6.85
Conductivity	193	165	186	225	232	261	122
Residue Nonfiltrable, TSS dried at 103-105°C	3.0	6.7	2.0	5.5	2.0	4.5	10
Color, PCU	80	120	100	40	40	90	360
Turbidity, NTU	1.6	1.3	0.45	1.2	0.75	1.5	1.3
II. Nonmetals							
Sulfate, SO_4	30	30	20	57	50	47	9.0
Fluoride, F	0.40	0.40	0.43	0.52	0.54	0.41	0.26
Phosphorous:							
Total Phosphate, P	0.61	0.51	0.66	0.59	0.69	0.57	0.60
Ortho Phosphate, P	0.56	0.49	0.61	0.59	0.67	0.53	0.50
Alkalinity Total, $CaCO_3$	34	37	39	40	47	32	23

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-10. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-12 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14 77	10-27-77	11-22-77	12-13-77
I. Physical Examination							
Temperature°C	24.0	26.0	25.5	26.0	21.1	21.0	21.0
pH	6.6	6.53	6.90	6.73	7.00	7.00	6.75
Conductivity	345	213	220	162	228	265	286
Residue Nonfiltrable, TSS dried at 103-105°C	1.0	1.7	1.0	14.3	2.0	5.0	3.0
Color, PCU	60	450	400	500	100	60	100
Turbidity, NTU	1.0	2.0	1.0	0.85	0.7	0.75	1.2
II. Nonmetals							
Sulfate, SO_4	75	18	26	19	33	40	33
Fluoride, F	0.11	0.15	0.46	0.30	0.21	0.50	0.47
Phosphorous:							
Total Phosphate, P	0.75	1.08	0.85	0.90	0.66	0.66	0.62
Ortho Phosphate, P	0.70	0.98	0.81	0.75	0.59	0.52	0.58
Alkalinity Total, $CaCO_3$	30	24	39	26	38	40	40

PARAMETERS	DATE COLLECTED						
	1-11-78	2-13-78	3-23-78	4-18-78	5-18-78	6-21-78	7-26-78
I. Physical Examination							
Temperature°C	10.2	15.0	19.8	21.0	22.8	23.4	26.5
pH	7.15	6.90	7.00	6.95	6.52	6.90	6.60
Conductivity	190	100	210	250	229	247	122
Residue Nonfiltrable, TSS dried at 103-105°C	4.0	5.8	5.5	10	3.5	13	7
Color, PCU	50	120	125	40	40	90	300
Turbidity, NTU	12	1.3	0.98	1.4	0.60	1.7	1.0
II. Nonmetals							
Sulfate, SO_4	30	30	35	64	47	43	9.0
Fluoride, F	0.44	0.41	0.49	0.51	0.54	0.43	0.27
Phosphorous:							
Total Phosphate, P	0.53	0.48	0.75	0.48	0.65	0.59	0.63
Ortho Phosphate, P	0.50	0.43	0.66	0.42	0.63	0.53	0.54
Alkalinity Total, $CaCO_3$	40	40	38	41	43	31	24

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-11. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-13 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-13-77
I. Physical Examination							
Temperature°C	26.8	26.0	27.2	26.5	25.0	23.0	18.1
pH	6.80	6.95	6.30	6.00	6.90	7.00	6.61
Conductivity	225	250	130	112	152	180	160
Residue Nonfiltrable, TSS dried at 103-105°C	8.5	2.0	10	28.5	8.0	16	0.0
Color, PCU	28	280	560	285	150	150	200
Turbidity, NTU	4.2	1.3	3.3	1.1	0.68	2.0	1.4
II. Nonmetals							
Sulfate, SO_4	18	29	15	6.0	13	12	10
Fluoride, F	0.45	0.23	0.30	0.30	0.12	0.60	0.33
Phosphorous:	*						
Total Phosphate, P	1.28	1.26	1.20	1.05	0.60	0.76	0.43
Ortho Phosphate, P	1.09	1.10	1.07	1.00	0.52	0.75	0.40
Alkalinity Total, $CaCO_3$	79	47	21	21	3.5	51	29

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-18-78	5-18-78	6-22-78	7-25-78
I. Physical Examination							
Temperature°C	12.5	17.4	21.0	26	24.9	23.8	28.0
pH	7.40	6.64	6.90	7.30	6.82	6.75	6.40
Conductivity	154	150	68	111	190	288	102
Residue Nonfiltrable, TSS dried at 103-105°C	2.5	6.5	3.0	18	3.0	8.5	7.0
Color, PCU	150	180	175	30	20	250	300
Turbidity, NTU	1.3	1.1	0.80	6.5	0.65	2.1	1.4
II. Nonmetals							
Sulfate, SO_4	13	17	13	12	10	47	4.0
Fluoride, F	0.36	0.37	0.46	0.88	0.86	0.35	0.22
Phosphorous:							
Total Phosphate, P	0.60	0.46	0.86	0.840	0.88	0.890	0.79
Ortho Phosphate, P	0.53	0.53	0.41	0.840	0.87	0.600	0.67
Alkalinity Total, $CaCO_3$	36	35	50	87	92	35	16

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-12. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-14 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-21-77	12-14-77
I. Physical Examination							
Temperature°C	(DRY)	26.5	28.0	26.8	25.0	20.0	18.2
pH		7.10	6.75	6.30	6.99	7.20	6.81
Conductivity		262	128	120	155	159	118
Residue Nonfiltrable, TSS dried at 103-105°C		3.0	17.5	26.5	8.7	21	3.5
Color, PCU		260	410	275	125	150	220
Turbidity, NTU		1.2	3.9	1.1	0.65	1.2	1.4
II. Nonmetals							
Sulfate, SO_4		30	12	6.5	15	12	10
Fluoride, F		0.24	0.25	0.4	0.12	0.60	0.34
Phosphorous:							
Total Phosphate, P		1.27	1.20	.05	0.57	0.84	0.48
Ortho Phosphate, P		1.13	0.97	1.00	0.50	0.45	0.40
Alkalinity Total, $CaCO_3$		50	18	24	5.0	54	22

PARAMETERS	DATE COLLECTED						
	1-10-78	2-13-78	3-23-78	4-18-78	5-18-78	6-22-78	7-25-78
I. Physical Examination							
Temperature°C	12.0	19.0	19.2	23.1	(DRY)	23.8	29.0
pH	6.90	7.05	7.10	7.60		6.90	6.70
Conductivity	154	152	173	202		263	105
Residue Nonfiltrable, TSS dried at 103-105°C	1.0	4.3	2.0	2.5		6.5	11
Color, PCU	150	150	125	30		250	400
Turbidity, NTU	1.2	1.0	0.42	1.2		1.7	1.3
II. Nonmetals							
Sulfate, SO_4	12	15	13.4	12		42	4.6
Fluoride, F	0.37	0.38	0.47	0.86		0.36	0.23
Phosphorous:							
Total Phosphate, P	0.58	0.46	0.87	0.98		0.58	0.81
Ortho Phosphate, P	0.54	0.44	0.81	0.71		0.54	0.68
Alkalinity Total, $CaCO_3$	32	31	59	93		35	17

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-13. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-15 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-22-77	12-15-77
I. Physical Examination							
Temperature°C	27.8	27.1	28.5	27.0	22.5	21.2	20.2
pH	7.70	6.80	6.88	6.70	7.20	7.70	7.05
Conductivity	810	254	324	284	330	429	330
Residue Nonfiltrable, TSS dried at 103-105°C	3.0	6.0	10	14.3	6.7	8.5	8.5
Color, PCU	20	300	180	210	100	30	100
Turbidity, NTU	1.5	3.9	5.5	1.9	1.0	0.5	3.5
II. Nonmetals							
Sulfate, SO_4	134	50	80	17	92	142	17
Fluoride, F	2.6	0.38	1.30	1.00	1.03	2.20	1.45
Phosphorous:							
Total Phosphate, P	8.8	1.76	2.95	2.45	2.60	3.10	2.75
Ortho Phosphate, P	3.6	1.45	2.82	2.35	2.30	2.75	2.50
Alkalinity Total, $CaCO_3$	70	30	45	46	33	75	54

PARAMETERS	DATE COLLECTED						
	1-11-78	2-13-78	3-23-78	4-18-78	5-22-78	6-22-78	7-25-78
I. Physical Examination							
Temperature°C	13.2	17.0	22.5	24.9	25.1	24.9	27.0
pH	7.05	7.70	7.65	7.48	7.10	7.70	6.80
Conductivity	272	260	295	358	264	331	222
Residue Nonfiltrable, TSS dried at 103-105°C	2.5	2.0	19	5.5	11	8.0	20
Color, PCU	90	80	100	30	80	150	300
Turbidity, NTU	2.4	1.4	2.4	1.4	2.5	2.3	2.7
II. Nonmetals							
Sulfate, SO_4	73	74	80	100	67	80	40
Fluoride, F	1.20	1.30	1.3	2.1	1.5	1.40	0.88
Phosphorous:							
Total Phosphate, P	2.70	2.10	1.93	2.60	1.90	2.08	1.58
Ortho Phosphate, P	2.20	1.90	1.83	2.55	1.70	1.96	1.55
Alkalinity Total, $CaCO_3$	60	75	[illegible]	118	56	45	37

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-14. MONTHLY CHEMICAL ANALYSES OF SURFACE WATER SAMPLES FROM STATION SW-16 ON THE FARMLAND INDUSTRIES, INC. MINE PROPERTY IN HARDEE COUNTY, FLORIDA; JUNE 1977 - JULY 1978.

PARAMETERS	DATE COLLECTED						
	6-14-77	7-20-77	8-17-77	9-14-77	10-27-77	11-22-77	12-15-77
I. Physical Examination							
Temperature°C	28.0	27.3	28.5	27.0	22.5	21.9	20.1
pH	7.70	6.65	6.85	6.70	7.20	7.80	7.10
Conductivity	486	274	315	284	335	435	330
Residue Nonfiltrable, TSS dried at 103-105°C	2.0	8.7	7.0	8.5	4.7	6.0	9.5
Color, PCU	25	300	190	200	125	30	150
Turbidity, NTU	1.1	3.5	3.6	5.4	1.3	0.5	3.5
II. Nonmetals							
Sulfate, SO_4	130	49	75	72	82	114	83
Fluoride, F	2.55	0.37	1.25	1.00	1.03	2.10	1.50
Phosphorous:							
Total Phosphate, P	3.4	1.58	2.85	2.45	2.53	3.00	2.60
Ortho Phosphate, P	3.4	1.48	2.71	2.30	2.35	2.25	2.45
Alkalinity Total, $CaCO_3$	69	30	44	45	62	72	59

PARAMETERS	DATE COLLECTED						
	1-11-78	2-13-78	3-24-78	4-18-78	5-18-78	6-21-78	7-26-78
I. Physical Examination							
Temperature°C	13.1	16.0	22.6	24.2	24.9	25.5	27.0
pH	6.90	7.70	7.62	7.48	7.12	7.69	6.71
Conductivity	255	245	285	352	260	329	227
Residue Nonfiltrable, TSS dried at 103-105°C	2.5	13	24	3.0	7.5	8.0	23
Color, PCU	100	90	100	30	100	120	280
Turbidity, NTU	2.3	2.0	2.8	2.4	2.7	2.1	2.4
II. Nonmetals							
Sulfate, SO_4	80	67	72	100	58	80	43
Fluoride, F	1.28	1.30	1.30	2.10	1.40	1.40	0.87
Phosphorous:							
Total Phosphate, P	2.25	2.25	2.03	2.75	1.60	2.02	1.58
Ortho Phosphate, P	2.15	1.90	1.85	2.60	1.55	1.94	1.50
Alkalinity Total, $CaCO_3$	59	55	56	74	52	47	37

Source: P.E. LaMoreaux & Associates, Inc. (1978).

Table D-15. RESULTS OF LABORATORY ANALYSES OF SURFACE WATER FROM VARIOUS LOCATIONS[1] ON THE PROPOSED FARMLAND INDUSTRIES, INC. MINE PROPERTY, HARDEE COUNTY, FLORIDA; OCTOBER 1979 AND MARCH 1980,[2] (Continues, Page 1 of 2).

Parameter	LOCATION M5 Oct. '79	 M5 March '80	 M6 Oct. '79	 M6 March '80	 M7 Oct. '79	 M7 March '80
Bacteriological and Miscellaneous						
Oxidation Reduction Potential, mv	180	128	175	122	205	122
pH, pH Units	6.7	7.9	6.6	7.3	6.5	7.2
Specific Conductance, umhos/cm	110	112	149	137	242	274
Total Dissolved Solids, mg/l	142	238	143	209	227	241
Total Suspended Solids, mg/l	ND[4]	3	2	1.6	3	1.0
Turbidity, NTU	3.0	1.6	2.8	1.8	4.0	2.6
Color, units	320	112	280	77	230	57
Fecal Streptococcal Bacteria, colonies/100 ml	470	370	150	168	310	200
Fecal Coliform Bacteria, colonies/100 ml	290	1,700	360	400	660	1150
Dissolved Oxygen, mg/l	7.8	9.8	7.1	9.9	8.3	9.6
BOD_5, mg/l	ND	ND	ND	ND	ND	ND
Nutrients						
Ammonia Nitrogen, mg/l as N	ND	0.82	ND	ND	ND	ND
Total Kjeldahl Nitrogen, mg/l as N	5.8	0.82	4.4	0.70	9.5	0.70
Organic Nitrogen, mg/l as N	5.8	0	4.4	0.70	9.5	0.70
Orthophosphate, as PO_4, mg/l	1.62	1.20	2.32	0.94	2.51	1.15
Total Phosphorus, as PO_4, mg/l	1.62	1.20	2.32	0.94	2.51	1.15
Nitrate/Nitrogen, mg/l as N	0.57	0.36	0.59	0.27	2.6	2.6
Nitrite/Nitrogen, mg/l as N	ND	ND	ND	ND	0.024	ND
Cations and Minerals						
Calcium, mg/l	14	14	14	34	19	23
Calcium Hardness, mg/l as $CaCO_3$	35	35	35	85	47	57
Magnesium, mg/l	4.5	7.2	5.6	7.0	9.0	11.1
Magnesium Hardness, mg/l as $CaCO_3$	19	30	23	29	37	46
Total Hardness, by EDTA Titration, mg/l as $CaCO_3$	50	72	60	84	86	112
Sodium, mg/l	7.6	11.4	8.8	11.3	9.8	10.5
Potassium, mg/l	1.28	4.4	2.1	4.7	5.4	4.0
Silica, mg/l as SiO_2 by AA	8.6	6	11	6	8.6	9
Iron, Ferrous, mg/l	0.70	0.38	0.55	0.35	0.68	0.32
Iron, Total, mg/l	1.01	0.52	1.09	0.51	0.96	0.45
Anions						
Alkalinity, Partial, mg/l as $CaCO_3$	0	0	0	0	0	0
Alkalinity, Total, mg/l as $CaCO_3$	28	30	33	30	34	39
Bicarbonate, mg/l as HCO_3	34	37	40	37	41	47
Carbonate, mg/l as CO_3	0	0	0	0	0	0
Chloride, mg/l	13	29	18	34	48	29
Cyanide, mg/l	ND	ND	ND	ND	ND	.125
Fluoride, mg/l	0.25	ND	0.36	ND	0.41	ND
Sulfate, mg/l	ND	12	ND	23	32	44
Sulfide, mg/l[5]	0.08	ND	0.04	0.42	0.08	0.50
Heavy Metals						
Arsenic, mg/l	ND	ND	ND	ND	0.002	ND
Barium, mg/l	ND	0.01	ND	ND	ND	0.01
Beryllium, mg/l	ND	ND	ND	ND	ND	ND
Cadmium, mg/l	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent, mg/l	ND	0.014	ND	0.012	ND	.012
Copper, mg/l	0.0025	0.0036	0.0037	0.0038	0.0037	0.0038
Lead, mg/l	ND	ND	ND	ND	ND	ND
Manganese, mg/l	0.006	0.011	0.014	0.008	0.012	0.02
Mercury, mg/l	ND	ND	ND	ND	0.0002	0.0001
Nickel, mg/l	ND	ND	ND	ND	ND	ND
Selenium, mg/l	ND	ND	0.001	ND	0.001	ND
Silver, mg/l	ND	ND	ND	ND	ND	ND
Zinc, mg/l	ND	ND	0.14	ND	0.12	ND

Table D-15. RESULTS OF LABORATORY ANALYSES OF SURFACE WATER FROM VARIOUS LOCATIONS[1] ON THE PROPOSED FARMLAND INDUSTRIES, INC. MINE PROPERTY, HARDEE COUNTY, FLORIDA; OCTOBER 1979 AND MARCH 1980[2], (Concluded, Page 2 of 2).

	LOCATION					
	M5		M6		M7	
Parameter	Oct. '79	March '80	Oct. '79	March '80	Oct. '79	March '80
Organics						
Total Organic Carbon, mg/l	32	45	21	34	21	34
Dissolved Organic Carbon, mg/l	32	39	19	32	21	35
Phenolic Compounds, mg/l	0.010	.007	0.016	.008	0.012	.005
Surfactants, mg/l as MBAS	0.17	.11	0.074	.09	0.27	ND
Oil and Grease, mg/l	1	ND	ND	ND	1	ND
Organochlorine Pesticides						
Lindane, ug/l	ND		ND		ND	
Heptachlor, ug/l	ND		ND		ND	
Aldrin, ug/l	ND		ND		ND	
Dieldrin, ug/l	ND		ND		ND	
Endrin, ug/l	ND		ND		ND	
Endosulfan, ug/l	ND		ND		ND	
p, p-DDT, ug/l	ND		ND		ND	
Methoxychlor, ug/l	ND		ND		ND	
Toxaphene, ug/l	ND		ND		ND	
Chlordane, ug/l	ND		ND		ND	
PCB's, ug/l	ND		ND		ND	
Mirex, ug/l	ND		ND		ND	
Phenoxy Acid Herbicides						
2, 4 - D, ug/l	ND		ND		ND	
2, 4, 5 - TP (Silvex), ug/l	ND		ND		ND	
Organophosphorous Pesticides						
Demeton, ug/l	ND		ND		ND	
Malathion, ug/l	ND		ND		ND	
Parathion, ug/l	ND		ND		ND	
Guthion, ug/l	ND		ND		ND	
Gross Alpha, pCi/l	0.0±2.5		0.0±2.5		0.0±2.5	
Thorium-230, pCi/l	ND		ND		ND	
Gross Beta, pCi/l	0.0±2.0		0.0±2.0		0.0±2.0	
Total Uranium, ug/l	ND		ND		ND	
Radium-226, pCi/l	0.11±0.06		0.00±0.05		0.24±0.06	

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[1] Sample locations M5, M6, and M7 are located where Oak, Hickory, and Troublesome Creeks leave Farmland property.

[2] Analyses performed for Woodward-Clyde Consultants (WCC) by Wilson Laboratories, Salina, Kansas.

[3] Result may be artificially high due to finely divided particles not removed by 0.45 μ filter.

[4] None detected.

[5] Undissociated sulfide is approximately 80% of these levels according to the pH, conductivity, and temperature data using 14th Edition Std. Methods, pg. 507.

APPENDIX E
SOIL PROFILE DESCRIPTIONS

This Appendix presents detailed information regarding the distribution, usage, and physical and chemical characteristics of soils occurring on the Farmland site. The descriptions are presented in the alphabetical order of the soil names as listed in Figures 4-7 and 4-8 of this SID. Figure 4-7 is based on the 1950 classification, while Figure 4-8 is based on the 1979 reclassification (which covers only a portion of the site). Separate descriptions are provided for each classification effort (i.e., 1950 and 1979).

E.1 SOILS OF THE 1950 SOIL SURVEY

BLANTON FINE SAND

Ap - 0 to 7 Inches

Very dark grayish brown* (10YR 3/2) sand; weak fine granular structure; friable with many fine and medium roots; common uncoated light gray sand grains; strongly acid; abrupt wavy boundary (3 to 9 inches thick).

C1 - 7 to 25 Inches

Very pale brown (10YR 7/3) sand; few fine faint yellowish brown mottles; single grained; loose; common fine roots; common very fine carbon particles; many uncoated sand grains; strongly acid; gradual wavy boundary (4 to 22 inches thick).

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*Colors are for moist sand unless otherwise noted.

C2 - 25 to 34 Inches

Light yellowish brown (10YR 6/4) sand; single grained; loose; few fine roots; many uncoated sand grains; strongly acid; gradual wavy boundary (4 to 12 inches thick).

C3 - 34 to 61 Inches

Very pale brown (10YR 7/3) sand; few medium faint yellow mottles; single grained; loose; many uncoated sand grains; strongly acid; clear wavy boundary (18 to 34 inches thick).

C4 - 61 to 99 Inches

White (10YR 8/2) sand; common medium faint very pale brown mottles; single grained; loose; many uncoated sand grains; abundance of mottles decreased at lower depths; strongly acid.

Taxonomic Class

Hyperthermic, uncoated, Typic Quartipsamments.

BRIGHTON PEAT

Oap - 0 to 5 Inches

Very dark brown (10YR 2/2), very dark brown (10YR 2/2) rubbed and pressed, well decomposed organic material (muck); about 15 percent fiber, 5 percent, rubbed; moderate, medium granular structure; friable; many fine roots; sodium pyrophosphate brown (10YR 5/3); extremely acid, pH 4.2 in 0.01M $CaCl_2$; clear smooth boundary (4 to 10 inches thick).

Oa2 - 5 to 13 Inches

Dark reddish brown (5YR 2/2) rubbed and pressed, well decomposed organic material (muck); about 30 percent fiber, 5 percent rubbed; moderate medium granular structure; friable; common fine roots; about 10 percent mineral as light gray (10YR 6/1) sand streaks; sodium pyrophosphate brown (10YR 5/3); extremely acid; pH 4.2 in 0.01M $CaCl_2$; gradual smooth boundary (4 to 12 inches thick).

Oa3 - 13 to 27 Inches

Black (10YR 2/1), rubbed and pressed, decomposed organic matter (muck); about 20 percent fiber, 5 percent fiber, rubbed; weak coarse subangular blocky structure; friable; common fine roots; about 10 percent mineral material; sodium pyrophosphate dark brown (10YR 3/3); extremely acid; pH 4.4 in 0.01M $CaCl_2$; abrupt wavy boundary (8 to 18 inches thick).

11C1 - 27 to 31 Inches

Very dark gray (10YR 3/1) sand; common coarse faint dark gray (10YR 4/1) and light gray (10YR 6/1) streaks; single grain; loose, extremely acid, pH 4.3 in 0.01M $CaCl_2$; clear wavy boundary (3 to 5 inches thick).

11C2 - 31 to 35 Inches

Gray (10YR 5/1) sand; single grain; loose; extremely acid; pH 4.3 in 0.01M $CaCl_2$; abrupt wavy boundary (0 to 4 inches thick).

111C3 - 35 to 46 Inches

Dark gray (10YR 4/1) sandy clay loam; few fine faint dark grayish brown mottles; weak coarse subangular blocky structure; friable; few crayfish burrows filled with gray sand; extremely acid; pH 3.4 in 0.01M $CaCl_2$; clear wavy boundary (6 to 18 inches thick).

Taxonomic Class

Loamy, siliceous, dysic, hyperthermic, Terric Medisaprists.

ST. LUCIE FINE SAND

01 - 1/4 to 0 Inches

Leaf mold, forest litter; partially decomposed leaves.

A1 - 0 to 3 Inches

Gray (10YR 5/1) rubbed sand; single grained; loose; few roots; many large and medium pores; strongly acid; clear smooth boundary (1 to 4 inches).

C1 - 3 to 60 Inches

Light gray (10YR 7/1) sand; single grained; loose; few roots; narrow vertical streaks of gray to light gray (10YR 6/1) in upper 5 inches; many large and medium pores; sand grains lack coating; strongly acid; gradual wavy boundary (4 to 60 inches thick).

C2 - 60 to 84 Inches

White (10YR 8/1) sand; single grained; loose; many large and medium pores; sand grains lack coating; strongly acid.

Taxonomic Class

Hyperthermic, uncoated typic Quartzipsamments.

E.2 SOILS OF THE 1979 SOIL SURVEY

BASINGER FINE SAND

A1 - 0 to 2 Inches

Very dark gray (10YR 3/1) rubbed, fine sand; weak, fine granular structure; very friable; many fine roots; many uncoated light gray sand grains; strongly acid; clear smooth boundary (2 to 8 inches thick).

A2 - 2 to 18 Inches

Light gray (10YR 7/2) fine sand; single grained; loose; few fine and medium roots; very dark streaks along root channels; very strongly acid; clear wavy boundary (5 to 30 inches thick).

Bh&A - 18 to 36 Inches

Brown (10YR 5/3) and light brownish gray (10YR 6/2) fine sand; common medium distinct dark reddish brown (5YR 3/2) weakly cemented bodies and few fine faint yellowish brown mottles; common medium distinct very dark grayish brown (10YR 3/2) streaks in root channels; single grained; loose; few fine medium roots; brown color of Bh portion is due to thin coatings of colloidal organic matter on sand grains, light brownish gray is uncoated A2 horizon material; many uncoated sand grains in Bh portion; strongly acid; gradual wavy boundary (6 to 20 inches thick).

C2 - 36 to 60 Inches

Light brownish gray (10YR 6/2) fine sand; single grained; loose; many uncoated sand grains; strongly acid.

Taxonomic Class

Siliceous, hyperthermic Spodic Psammaquents.

BLUFF SANDY CLAY

A11 - 0 to 6 Inches

Black (M2/1) sandy clay; weak medium subangular blocky structure; firm; few fine and medium roots; medium acid; clear wavy boundary (4 to 8 inches thick).

A12 - 6 to 13 Inches

Black (10YR 2/1) sandy clay; weak medium subangular blocky structure; firm; few fine and medium roots and pores; medium acid; clear wavy boundary (6 to 12 inches thick).

A13 - 13 to 17 Inches

Very dark gray (N3/) sandy clay, weak medium subangular blocky structure; very firm, very plastic and sticky, hard when dry; few fine roots and pores; slightly acid; clear wavy boundary (4 to 22 inches thick).

B2tg - 22 to 32 Inches

Gray (10YR 5/1) sandy loam; many medium and coarse distinct yellowish red (5YR 5/8) and brownish yellow (10YR 6/8) mottles; weak coarse subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; few medium pores; clay bridging between some sand grains; thin patchy clay films on faces of ped; neutral; clear irregular boundary (6 to 14 inches thick).

B3g - 32 to 42 Inches

Dark gray (N4/) loamy fine sand; few coarse distinct brown (10YR 4/3) mottles; single grained; loose; pockets and lenses of fine sandy loam; mildly; clear wavy boundary (4 to 10 inches thick).

Cg - 42 to 60 Inches

White (N8/) fine sand; single grained; loose; narrow lenses and small pockets of gray fine sandy loam; mildly alkaline.

Taxonomic Class

Loamy, siliceous hyperthermic Arenic Ochraqualfs.

BRADENTON FINE SAND, FREQUENTLY FLOODED

A1 - 0 to 4 Inches

Very dark gray (10YR 3/1) fine sand; weak fine crumb structure; very friable; many fine and medium roots; mixture of organic matter and light gray sand grains has salt-and-pepper appearance; medium acid; clear smooth boundary (4 to 6 inches thick).

A2 - 4 to 10 Inches

Grayish brown (10YR 5/2) fine sand; few medium distinct dark gray (10YR 4/1) mottles; single grained; loose; many fine and medium roots; medium acid; abrupt smooth boundary (4 to 14 inches thick).

B21tg - 10 to 19 Inches

Dark gray (10YR 4/1) fine sandy loam; many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium blocky structure; friable; common fine and medium roots; few thin discontinuous clay flows on faces of peds and in root channels; few fine streaks of gray sand; slightly acid; gradual wavy boundary (6 to 16 inches thick).

B22tg - 19 to 26 Inches

Gray (10YR 5/1) fine sandy loam; many fine distinct yellowish brown and olive brown mottles; weak subangular blocky structure parting to medium fine granular; friable; few medium and coarse roots; few fine streaks of light gray sand grains in root channels; sand grains are coated and bridged with clay; common soft white calcium carbonate accumulations and common fine white calcium carbonate nodules in lower 4 inches; mildly alkaline; gradual wavy boundary (6 to 14 inches thick).

C1ca - 26 to 34 Inches

White (N 8/0) fine sandy loam; massive; slightly sticky and slightly plastic; few coarse roots; sand grains are coated with carbonates; few root channels; common streaks and pockets of grayish brown (10YR 5/2) moderately alkaline; calcareous; clear wavy boundary (8 to 30 inches thick).

C2ca - 34 to 70 Inches

Light brownish gray (2.5Y 6/2) fine sandy loam; common medium distinct light olive brown (2.5Y 5/6) and few fine distinct olive brown (2.5Y 4/4) mottles; massive; slightly sticky; many medium carbonate nodules; sand grains coated with carbonates; common streaks and pockets of light gray; fine sand; moderately alkaline; calcareous.

Taxonomic Class

Coarse-loamy, mixed, hyperthermic Typic Ochraqualfs.

CASSIA FINE SAND

A1 - 0 to 4 Inches

Gray (10YR 5/1) rubbed, sand; single grained; loose, many fine roots; very strongly acid; clear wavy boundary (2 to 5 inches thick).

A2 - 4 to 25 Inches

Light gray (10YR 7/1) sand; few medium faint dark gray (10YR 4/1) mottles and streaks; single grained; loose; few fine and medium roots; very strongly acid; abrupt smooth boundary (8 to 25 inches thick).

B21h - 25 to 28 Inches

Dark reddish brown (5YR 2/2) sand; few coarse pockets of light brownish gray; massive; parting to moderate fine granular; firm and weakly cemented; sand grains coated with organic material; many fine roots; very strongly acid; clear wavy boundary (3 to 8 inches thick).

B22h - 28 to 37 Inches

Dark reddish brown (5YR 3/3) sand; massive, parting to moderate medium granular structure; firm and weakly cemented; sand grains are coated with organic material; very strongly acid; clear wavy boundary (6 to 12 inches thick).

C - 37 to 80 Inches

Very pale brown (10YR 7/3) sand; common medium faint brown (10YR 5/3) and few fine distinct strong brown mottles; single grained; loose; very strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Typic Haplohumods.

DELRAY MUCKY FINE SAND, DEPRESSIONAL

Ap - 0 to 8 Inches

Black (10YR 2/1) fine sand; weak coarse crumb structures; friable; many fine roots; few coarse faint dark sand pockets; about 5 to 10 percent organic matter; slightly acid; clear smooth boundary (6 to 10 inches thick).

A12 - 8 to 18 Inches

Black (10YR 2/1) fine sand; many medium and coarse faint dark gray and very dark gray streaks and mottles; weak fine crumb structure; very friable; many fine roots; about 5 percent organic matter; slightly acid; gradual wavy boundary (4 to 14 inches).

A2 - 18 to 46 Inches

Gray (10YR 5/1) fine sand; single grained; loose; common fine and medium faint dark gray and very dark gray grains along old root channels; many fine roots that decrease with depth; common fine pores; neutral; abrupt wavy boundary (30 to 50 inches thick).

B2tg - 46 to 60 Inches

Dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable; most sand grains coated and bridged with clay, some are uncoated; mildly alkaline; gradual irregular boundary (6 to 30 inches thick).

B3g - 60 to 75 Inches

Grayish brown (10YR 5/2) loamy fine sand; few medium distinct light olive brown (2.5Y 5/4) and brownish yellow (10YR 6/6) mottles; massive; very friable; common pockets of light gray fine sand and gray to dark gray fine sandy loam; most sand grains coated and bridged with clay, some are uncoated; mildly alkaline.

Taxonomic Class

Loamy, mixed, hyperthermic, Grossarenic Argiaquolls.

FELDA FINE SAND, FREQUENTLY FLOODED

A1 - 0 to 4 Inches

Black (10YR 2/1) rubbed, fine sand; weak fine crumb structure; friable; many fine and medium roots; mixture of organic matter and light gray sand grains give a salt-and-pepper effect; strongly acid; clear wavy boundary (3 to 6 inches thick).

A21 - 4 to 8 Inches

Grayish brown (10YR 5/2) fine sand; many fine faint very dark gray, dark gray and brown streaks and mottles; single grained; loose; many fine roots; many clear sand grains; slightly acid; clear wavy boundary (3 to 8 inches).

A22 - 8 to 22 Inches

Light gray (10YR 7/2) fine sand; single grained; loose; few fine and medium roots; slightly acid; clear smooth boundary (14 to 26 inches thick).

B2tg - 22 to 32 Inches

Gray (10YR 5/1) sandy loam; many medium and coarse distinct yellowish red (5YR 5/8) and brownish yellow (10YR 6/8) mottles; weak coarse subangular blocky structure; friable; slightly sticky, slightly plastic; few fine roots; few medium pores; clay bridging between some sand grains; thin patchy clay films on faces of ped; neutral; clear irregular boundary (6 to 14 inches thick).

B3g - 32 to 42 Inches

Dark gray (N 4/) loamy fine sand; few coarse distinct brown (10YR 4/3) mottles; single grained; loose; pockets and lenses of fine sandy loam; mildly; clear wavy boundary (4 to 10 inches thick).

Cg - 42 to 60 Inches

White (N 8/) fine sand; single grained; loose; narrow lenses and small pockets of gray fine sandy loam; mildly alkaline.

Taxonomic Class

Loamy, siliceous, hyperthermic Arenic Ochraqualfs.

FLORIDANA MUCKY FINE SAND, DEPRESSIONAL

A1 - 0 to 7 Inches

Black (N 2/0) sand; weak medium granular structure friable; common fine and few medium roots; sand grains coated with organic material; slightly acid; gradual smooth boundary (6 to 10 inches thick).

A12 - 7 to 12 Inches

Black (10YR 2/1) sand; weak fine granular structure; friable; common fine roots; many fine and medium faint gray (10YR 5/1) sand pockets and streaks; slightly acid; clear wavy boundary (4 to 12 inches thick).

A2 - 12 to 29 Inches

Grayish brown (2.5Y 5/2) sand; few medium prominent brownish yellow (10YR 6/6) and common coarse faint gray (10YR 5/1) mottles; single grained; loose; common medium roots; slightly acid; clear wavy boundary (9 to 18 inches thick).

B2tg - 29 to 38 Inches

Dark gray (10YR 4/1) sandy clay loam; common coarse faint light brownish gray (10YR 6/2) and few medium faint gray (10YR 5/1) mottles; weak coarse subangular blocky structure; slightly plastic; common fine and medium roots; few medium and fine pores; sand grains are coated and bridged with clay; mildly alkaline; gradual wavy boundary (6 to 14 inches thick).

B31g - 38 to 43 Inches

Dark gray (N 4/10) sandy clay loam; weak coarse subangular blocky structure; slightly firm common fine and medium roots; common fine and medium lenses of gray (10YR 5/1) sandy loam channels filled with light brownish gray (10YR 6/2) sand; few fine and medium pores; many uncoated sand grains; mildly alkaline; clear wavy boundary (4 to 10 inches thick).

B32g - 43 to 62 Inches

Gray (10YR 5/1) sandy loam; common coarse faint dark gray (N 4/0) sandy clay loam pockets; massive; friable; common fine and medium roots; common medium and coarse lenses and pockets of sand and loamy sand; mildly alkaline.

Taxonomic Class

Loamy, siliceous, hyperthermic Arenic Argiaquolls.

HONTOON MUCK

Oe - 0 to 5 Inches

Dark reddish brown (5YR 3/2) mucky peat; about 80 percent fiber, 60 percent rubbed; massive; friable; sodium pyrophosphate extract color is very pale brown (10YR 7/3); extremely acid; clear wavy boundary (0 to 10 inches thick).

OA1 - 5 to 14 Inches

Black (5YR 2/1) unrubbed and rubbed, well decomposed sapric material; about 20 percent fiber, 3 percent rubbed; weak medium subangular blocky structure; friable; sodium pyrophosphate extract color is brown (10YR 5/3) extremely acid; gradual wavy boundary (4 to 30 inches thick).

Oa2 - 14 to 60 Inches

Dark reddish brown (5YR 2/2) unrubbed and rubbed, well decomposed sapric material; about 22 percent fiber unrubbed, 2 percent rubbed; weak coarse subangular blocky structure; friable; sodium pyrophosphate extract color is dark reddish brown (10YR 3/2) extremely acid; clear wavy boundary (24 to 70 inches thick).

Oa3 - 60 to 65 Inches

Black (N 2/) highly decomposed organic matter (sapric) containing about 72 percent sand; about 2 percent fiber unrubbed, none rubbed; massive; friable; sodium pyrophosphate extract color is dark grayish brown (10YR 4/2); very strongly acid.

Taxonomic Class

Dysic, hyperthermic Typic Medisaprists.

IMMOKALEE FINE SAND

A1 - 0 to 6 Inches

Very dark gray (10YR 3/1) fine sand; mixture of organic matter and light gray sand grains has a salt-and-pepper appearance when dry; weak fine crumb structure very friable; many fine and medium roots; very strongly acid; clear smooth boundary (2 to 10 inches thick).

A21 - 6 to 12 Inches

Gray (10YR 6/1) fine sand, many coarse faint gray and few coarse faint gray mottles; single grained; loose; common fine and medium roots; very strongly acid; gradual wavy boundary (6 to 10 inches).

A22 - 12 to 35 Inches

White (10YR 8/1) fine sand; single grained; loose; few fine, medium and coarse roots; few fine very dark gray streaks in root channels; very strongly acid; wavy boundary (22 to 30 inches thick).

B21h - 35 to 43 Inches

Black (10YR 2/1) fine sand; lower 2 inches grades to dark reddish brown (5YR 2/2) weak fine granular structure; friable common fine and medium roots; very strongly acid; clear wavy boundary (4 to 12 inches thick).

B22h - 43 to 54 Inches

Dark reddish brown (5YR 3/3) fine sand; single grained; loose; few fine and medium roots; common fine and medium dark reddish brown (5YR 2/2); few fine distinct gray (10YR 5/1) sand lenses and pockets; very strongly acid; gradual wavy boundary (6 to 16 inches thick).

B3 - 54 to 72 Inches

Dark brown (10YR 4/3) fine sand, few fine faint dark brown, pale brown, and light gray mottles; single grained; loose; strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Arenic Haplaquods.

MYAKKA FINE SAND

A1 - 0 to 6 Inches

Black (10YR 2/1 crushed) sand; weak fine granular structure; very friable; matted with many fine and medium roots; strongly acid; clear smooth boundary (4 to 8 inches thick).

A2 - 6 to 20 Inches

White (10YR 8/2) sand; common fine faint vertical dark grayish brown, dark gray and gray streaks along root channels; single grained; loose; common fine and medium roots; strongly acid; abrupt wavy boundary (12 to 25 inches thick).

B21h - 20 to 24 Inches

Black (N 2/) sand, weak coarse subangular blocky structure; weakly cemented; many fine and medium roots; sand grains coated with organic matter, except for common fine pockets of uncoated sand grains; very strongly acid; clear wavy boundary (2 to 4 inches thick).

B22h - 24 to 32 Inches

Dark reddish brown (5YR 2/2) sand; common coarse faint vertical tongues of very dark brown (10YR 2/2) weak coarse subangular blocky structure; weakly cemented; many fine and medium roots; sand grains coated with organic matter; very strongly acid; clear smooth boundary (0 to 10 inches thick).

B23h - 32 to 36 Inches

Dark reddish brown (5YR 2/2) sand; weak fine granular structure; very friable; few fine roots; sand grains coated with organic matter; strongly acid; clear wavy boundary (4 to 8 inches thick).

B3 & Bh - 36 to 56 Inches

Dark brown (7.5Y 4/4) sand; weak fine granular structure; very friable; few fine roots; common medium distinct dark reddish brown (5YR 2/2) bodies that are weakly cemented; strongly acid; clear wavy boundary (3 to 22 inches thick).

C - 56 to 85 Inches

Dark grayish brown (10YR 4/2) sand; single grained; loose; few fine roots; strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Aeric Haplaquods.

ONA LOAMY FINE SAND

A1 - 0 to 6 Inches

Very dark gray (N/3) crushed, fine sand; weak fine crumb structure; friable; many fine and medium roots, mixture of black organic matter and light gray sand grains when dry; very strongly acid; clear smooth boundary (4 to 9 inches thick).

B21h - 6 to 10 Inches

Very dark brown (10YR 2/2) fine sand; weak coarse subangular blocky structure; firm, weakly cemented; common fine and medium roots; many sand grains are coated with organic matter; strongly acid; gradual wavy boundary (2 to 8 inches thick).

B22h - 10 to 20 Inches

Black (10YR 2/1) fine sand, common medium faint, very dark gray (10YR 3/1) very dark brown (10YR 2/2) and dark grayish brown (10YR 4/2) mottles; weak fine granular structure; firm; weakly cemented; common fine roots, many sand grains are coated with organic matter; few uncoated sand grains; strongly acid; clear wavy boundary (4 to 12 inches thick).

C1 - 20 to 58 Inches

Grayish brown (10YR 5/2) fine sand, common fine faint very dark gray, dark gray, dark grayish brown and light brownish gray mottles; single grained; few fine roots in upper part; many uncoated sand grains; strongly acid; clear wavy boundary (20 to 44 inches thick).

C2 - 58 to 68 Inches

White (10YR 8/1) fine sand; single grained; loose; many uncoated sand grains; strongly acid; abrupt smooth boundary (10 to 20 inches thick).

C3 - 68 to 82 Inches

Grayish brown (10YR 5/2) fine sand, few medium faint dark brown (7.5YR 3/2) mottles; single grained; loose; strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Typic Haplaquods.

PLACID FINE SAND, DEPRESSIONAL

A11 - 0 to 10 Inches

Black (10YR 2/1) fine sand; moderate medium crumb structure; friable; many fine and medium roots; few root channels few small pockets of dark gray (10YR 4/1) and gray (10YR 5/1) fine sand; very strongly acid; gradual smooth boundary (6 to 14 inches thick).

A12 - 10 to 20 Inches

Very dark gray (10YR 3/1) fine sand; weak fine crumb structure; very friable; many fine and medium roots; few root channels; lower portion of horizon has narrow tongues and pockets of black (10YR 2/1), dark gray (10YR 4/1) and very dark grayish brown (10YR 3/2); very strongly acid; clear wavy boundary (4 to 10 inches thick).

C1 - 30 to 48 Inches

Grayish brown (10YR 5/2) fine sand; common medium faint very dark gray and very dark grayish brown mottle; single grained; loose; strongly acid; gradual wavy boundary (12 to 24 inches thick).

C3 - 48 to 80 Inches

Dark grayish brown (10YR 4/2) fine sand; few fine faint very dark gray mottles; single grained; loose; strongly acid.

Taxonomic Class

Sand, siliceous, hyperthermic Typic Humaquepts.

POMONA FINE SAND

A1 - 0 to 2 Inches

Very dark gray (10YR 3/1) sand; weak fine crumb structure; very friable; common fine roots; very strongly acid; clear wavy boundary (4 to 6 inches thick).

A21 - 5 to 12 Inches

Gray (10YR 6/1) sand; common medium faint dark gray (10YR 4/1) mottles; single grained loose; common fine roots; sand grains are clean; very strongly acid; clear wavy boundary (6 to 8 inches thick).

A22 - 12 to 26 Inches

Light gray (10YR 7/1) sand; with few fine and medium faint light brownish gray (10YR 6/2) mottles; single grain; loose; common fine roots; sand grains are clean; very strongly acid; abrupt wavy boundary (9 to 16 inches thick).

B21h - 26 to 29 Inches

Mixed very dark gray (5YR 3/1) dark reddish brown (5YR 3/3) sand; moderate medium granular structure; friable; few fine roots; sand grains are coated with organic matter; very strongly acid; clear wavy boundary (3 to 6 inches thick).

B22h - 29 to 36 Inches

Very dark gray (5YR 3/1) sand, with few fine faint dark reddish brown mottles; moderate medium granular structure; friable; few fine roots; sand grains coated with organic matter; very strongly acid; clear wavy boundary (6 to 12 inches thick).

B3 - 36 to 39 Inches

Mixed dark brown (7.5YR 3/2) and dark grayish brown (10YR 4/2) sand; few fine distinct dark reddish brown (5YR 3/2) mottles; weak medium crumb structure; very friable; few roots; very strongly acid; clear wavy boundary (3 to 8 inches thick).

A'2 - 39 to 51 Inches

Brown (10YR 5/3) sand; single grained; loose; few fine roots; very strongly acid; clear wavy boundary (8 to 24 inches thick).

B'21tg - 51 to 58 Inches

Gray (10YR 6/1) sandy clay loam, with few fine and medium faint yellow (10YR 7/6) and few medium prominent yellowish red (5YR 4/8) mottles; weak medium subangular block structure; friable; thin patchy clay films on faces of peds; very strongly acid; clear wavy boundary (4 to 16 inches thick).

B'22tg - 58 to 72 Inches

Gray (10YR 5/1) light sandy clay, with few fine distinct light yellowish brown and few fine prominent yellowish red mottles; moderate medium subangular blocky structure; firm; thick patchy clay films on faces of peds; strongly acid.

Taxonomic Class

Sandy siliceous, hyperthermic, Ultic Haplaquods.

POMPANO FINE SAND, FREQUENTLY FLOODED

A11 - 0 to 5 Inches

Dark gray (10YR 4/1) fine sand; weak fine crumb structure; very friable; many fine roots; mixture of organic matter and light gray sand grains gives a salt-and-pepper appearance when dry; medium acid; gradual smooth boundary (2 to 8 inches thick).

A12 - 5 to 16 Inches

Grayish brown (10YR 5/2) fine sand; few fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; many fine roots; common fine streaks of dark grayish brown in roots channels; many sand grains are clean; slightly acid; gradual wavy boundary (3 to 13 inches thick).

C1 - 16 to 30 Inches

Very pale brown (10YR 7/3) fine sand, few coarse faint pale brown and few fine distinct yellow (10YR 7/6) and reddish yellow (5YR 6/8) mottles; single grained; loose; few fine roots; many clear sand grains; slightly acid; gradual wavy boundary (10 to 20 inches thick).

C2 - 30 to 75 Inches

Light gray (10YR 7/1) fine sand; single grained; loose slightly acid.

Taxonomic Class

Siliceous, hyperthermic family of Typic Psammaquents.

POMELLO FINE SAND

A1 - 0 to 4 Inches

Gray (N 6/) fine sand; weak fine granular structure; very friable; many fine and medium roots; very strongly acid; clear wavy boundary (1 to 6 inches thick).

A2 - 4 to 42 Inches

White (N 8/) fine sand; single grained; loose; common fine and medium roots, few coarse roots; few thin streaks of dark gray in old root channels; very strongly acid; abrupt wavy boundary (30 to 56 inches thick).

B21h - 42 to 47 Inches

Dark reddish brown (5YR 2/2) fine sand; masses of black (5YR 2/1) and dark reddish brown (2.5YR 3/4); weakly cemented; massive in place, parts to weak fine granular structure; friable; common fine and medium roots; sand grains are coated with organic matter; few small pockets light gray fine sand; very strongly acid; clear wavy boundary (2 to 8 inches thick).

B22h - 47 to 54 Inches

Dark reddish brown (5YR 3/3) fine sand; few coarse dark brown (7.5YR 3/2) mottles; massive, parts to weak fine granular structure; friable; few medium roots; sand grains are coated with organic matter; fragments of weakly cemented dark reddish brown (5YR 2/2); very strongly acid; clear wavy boundary (4 to 8 inches thick).

B3 - 54 to 66 Inches

Brown (10YR 4/3) fine sand; common medium faint brown and dark brown mottles; single grained; loose; very strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Arenic Haplohumods.

ST. LUCIE FINE SAND

O1 - 1/4 to 0 Inches

Leaf mold, forest litter; partially decomposed leaves.

A1 - 0 to 3 Inches

Gray (10YR 5/1) rubbed sand; single grained; loose; few roots; many large and medium pores; strongly acid; clear smooth boundary (1 to 4 inches thick).

C1 - 3 to 60 Inches

Light gray (10YR 7/1) sand; single grained; loose; few roots; narrow vertical streaks of gray to light gray (10YR 6/1) in upper 5 inches; many large and medium pores; sand grains lack coatings; strongly acid; gradual wavy boundary (4 to 60 inches thick).

C2 - 60 to 84 Inches

White (10YR 8/1) sand; single grained; loose; many large and medium pores; sand grains lack coatings; strongly acid.

Taxonomic Class

Hyperthermic, uncoated Typic Quartzipsamments.

SAMSULA MUCK

Oa1 - 0 to 9 Inches

Black (5YR 2/1) rubbed and pressed, well decomposed muck; about 20 percent fiber, 5 percent rubbed; moderate medium granular structure; friable; many fine roots, few medium roots; about 10 percent mineral material; sodium pyrophosphate extract color, very dark grayish brown (10YR 3/2); extremely acid; gradual smooth boundary (4 to 12 inches thick).

Oa2 - 9 to 36 Inches

Dark reddish brown (5YR 2/2) rubbed and pressed, well decomposed sapric material; about 15 percent fiber, 5 percent rubbed; moderate medium granular structure; friable; common fine roots; about 20 percent mineral material; sodium pyrophosphate extract color is very dark grayish brown (10YR 3/2); extremely acid; abrupt wavy boundary (12 to 28 inches thick).

IIAb - 36 to 46 Inches

Dark grayish brown (10YR 4/2) sand; common coarse faint very dark gray (10YR 3/1) mottles; single grained; loose; extremely acid; clear wavy boundary (4 to 18 inches thick).

IICb - 46 to 55 Inches

Gray (10YR 6/1) sand; common medium faint brown (10YR 5/3) mottles; single grained; loose; extremely acid.

Taxonomic Class

Sandy or sandy-skeletal, siliceous, Dysic hyperthermic Terric Medisaprists.

SMYRNA FINE SAND

A11 - 0 to 3 Inches

Black (10YR 2/1) crushed sand; weak coarse granular structure; very friable; many fine roots; strongly acid; gradual wavy boundary (2 to 6 inches thick).

A12 - 3 to 6 Inches

Very dark gray (10YR 3/1) crushed sand; single grained loose; common fine roots; strongly acid; clear wavy boundary (0 to 4 inches thick).

A2 - 6 to 13 Inches

Gray (10YR 5/1) sand; few medium distinct very dark gray (10YR gray (10YR 3/1) streaks along root channels; single grained; loose; few fine roots; strongly acid; abrupt wavy boundary (2 to 9 inches thick).

B21h - 13 to 18 Inches

Black (N 2/) sand; massive in place, parts to moderate medium granular structure; weakly cemented; many fine and medium decaying roots; sand grains coated with organic matter; upper 1/2 to 1-inch transition consisting of interfingering of black and gray sand; few medium distinct dark gray vertical uncoated sand streaks; very strongly acid; gradual wavy boundary (2 to 6 inches thick).

B22n - 18 to 28 Inches

Black (N 2/) sand; with common coarse distinct dark brown (7.5Y 3/2) mottles; massive in place, parts to moderate medium granular structure; weakly cemented few medium decaying roots; many uncoated sand grains in dark brown mottles; very strongly acid; clear wavy boundary (2 to 12 inches thick).

B3&Bh - 28 to 35 Inches

Dark brown (10YR 3/3) sand; common medium distinct weakly cemented black (N 2/) natural Bh fragments; single grained; loose; few fine decaying roots; sand grains in natural fragments are well coated with organic matter; strongly acid; clear wavy boundary (6 to 14 inches thick).

C1 - 35 to 43 Inches

Brown (10YR 5/3) sand; common coarse distinct gray grayish brown (10YR 4/2) and few coarse faint pale brown mottles; single grained; loose; strongly acid; clear wavy boundary (6 to 15 inches thick).

C2 - 43 to 56 Inches

Dark grayish brown (10YR 4/2) sand; few medium distinct brown (10YR 5/3) mottles; single grained loose; strongly acid; gradual wavy boundary (4 to 20 inches thick).

C3 - 56 to 80 Inches

Dark gray (10YR 4/1) sand; common medium faint dark grayish brown mottles; single grained; loose; strongly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Aeric Haplaquods.

ZOLFO FINE SAND

Ap - 0 to 6 Inches

Dark grayish brown (10YR 4/2) sand; single grained; loose; many fine and medium roots; neutral; clear smooth boundary (4 to 8 inches thick).

A21 - 6 to 21 Inches

Light brownish gray (10YR 6/2) fine sand; single grained; loose; many fine and medium roots; neutral; clear smooth boundary.

A22 - 12 to 43 Inches

Very pale brown (10YR 7/3) fine sand; common medium distinct yellow (10YR 7/6) mottles; that increase in abundance in the lower part of the horizon; single grained; loose; common fine and medium roots; neutral; gradual wavy boundary.

A23 - 43 to 54 Inches

Light gray (10YR 7/2) fine sand; common medium distinct yellow (10YR 7/6) mottles; single grained; loose; few fine and medium roots; neutral; gradual wavy boundary.

A24 - 54 to 62 Inches

Grayish brown (10YR 5/2) fine sand; single grained; loose; neutral; gradual wavy boundary (combined thickness of the A2 horizon is 46 to 70 inches).

B21h - 62 to 70 Inches

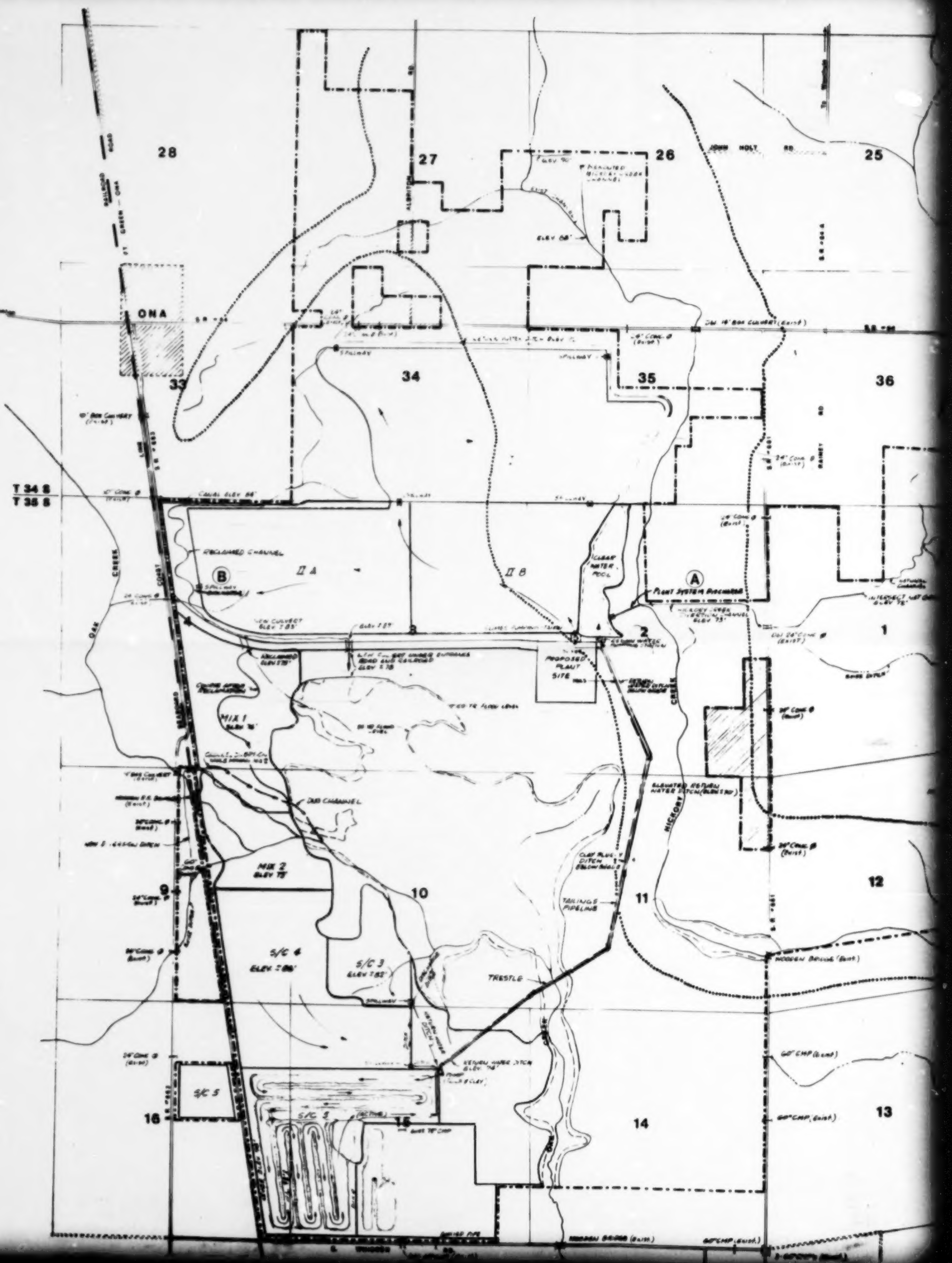
Dark reddish gray (5YR 4/2) fine sand; weak fine granular structure very friable; most sand grains are lightly coated with organic matter; slightly acid; gradual wavy boundary (6 to 10 inches thick).

B22h - 70 to 80 Inches

Dark reddish brown (5YR 3/2) fine sand, weak fine subangular blocky structure; very friable; most sand grains are well coated with organic matter; slightly acid.

Taxonomic Class

Sandy, siliceous, hyperthermic Grossarenic Entic Haplohumods.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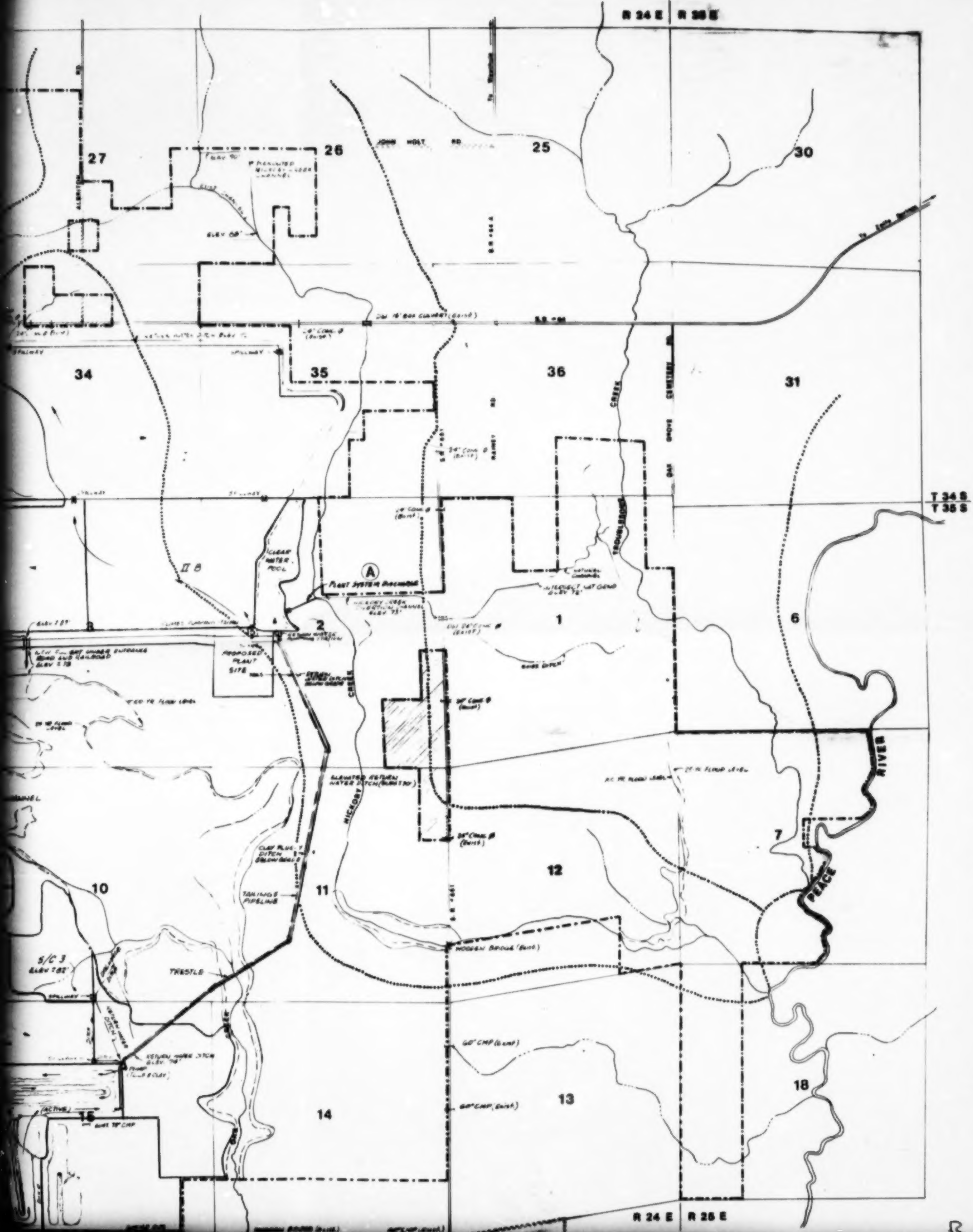
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